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THE

PHYSICAL DIAGNOSIS

OF

BRAIN DISEASE.

BY

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THE PHYSICAL DIAGNOSIS
OF
BRAIN DISEASE.

(*Extracts from a paper on "The Premonitory Symptoms of Apoplexy," read before the Medical Journal and Library Association, April* 28, 1871.)

IN determining the existence of any cerebral morbid process, especially that peculiar state of irritation which precedes the development of apoplectic symptoms, we have to employ physical means of research. In the diagnosis of brain diseases as well as of pulmonary diseases, we can employ instruments which increase the sensibility of our own sense organs, and by so doing recognize alterations which would otherwise pass unnoticed, and determine the existence of disease at an earlier date than is otherwise possible. These instruments are the æsthesiometer, the dynamometer, the thermometer, and the ophthalmoscope. The first enables us to interrogate the common sensation of the integument and its sensibility to pain, and, by a comparison of the two sides of the body, to discover any alterations due to pathological causes; while with the second we can pursue the same course in regard to the muscular power. The thermometer affords a ready means of accurately determining local variations of temperature, thus correcting or verifying conclusions arrived at by the rougher method of judging from our own sensations. The ophthalmoscope enables us to appreciate the condition of the retinal circulation, and, inferentially, that of the brain; to observe its increase and decrease under different physiological conditions and from

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various pathological causes; while, by permitting an easy examination of the optic nerves and retinal structures, we are enabled, in certain cases, to form accurate judgments of organic alterations in the brain substance.*

The connecting nervous threads which run from the peripheral expansions of gray matter, constituting the sensory endowments of the skin, to the primary nuclei in the spinal cord, must in some manner be connected with the cortical layer in the cerebral lobes, otherwise it would be impossible for us to become conscious of the sensations which it is their function to convey. It is probable that this connection is made by secondary fibres, running from the spinal nuclei to the sensory-motor ganglia at the base of the brain, and that from these latter other fibres are developed which place the investing gray matter of the cerebral hemispheres in immediate communication with the corpora striata and the optic thalami. The fact that the primary fibre from the integument to the cord terminates in the gray matter of the latter, and that in the other steps of the series communication is established through the connection of these nerve-centres, does not invalidate the statement that there is a direct connection between the periphery and the supreme centres, although it renders it doubtful if this communication is made by one uninterrupted nerve-thread.

The statement in regard to the connection between the superficial gray matter of the cerebrum and the peripheral expansions of nervous tissue which endow the integument with common sensation and the sensibility to pain, is equally true in relation to the cerebral lobes and the motor nerves of muscles. An uninterrupted communication between the supreme centres and the contractile organs is necessary for the conscious performance of voluntary muscular acts. Yet this communication may be, and doubtless is, affected by the intervention of a number of secondary centres and fibres.

Thus, in the nervous system, we have a structure which presents externally various apparatuses which reveal the changes going on within the cerebral organs. Excluding those symptoms which can be produced by local causes, and considering only those which are excited by encephalic disturbance, we shall devote our attention, first, to the manner in which these symptoms and signs are to be recognized, and then consider the cerebral changes which precede attacks of apoplexy, with special reference to the physical signs they originate.

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* Vance: "The Ophthalmoscope in the Treatment of Epilepsy."—*New York Medical Journal*, February, 1871.

In the employment of the æsthesiometer and dynamometer, as in the employment of the stethoscope, we seek to compare the results obtained on one side of the body with those obtained on the other side. In examining the respiratory organs, our diagnosis of disease depends upon the presence of signs on one side which do not exist on the other, and which experience has demonstrated to be no part of the phenomena of a healthy lung. In the use of the dynamometer and æsthesiometer, we pursue precisely the same course. The stethoscopic signs from which we arrive at the conclusion that a patient is suffering from consumption are in no sense specific, but can be produced by consolidation of the lung-tissue from any cause whatever. By auscultation and percussion, we are informed as to the density of the lung-substance, the presence or absence of liquid within the air-vesicles and bronchial tubes, and the existence of exudation between the surfaces of the pleuræ—anatomical conditions which can be produced by many different pathological processes. The history of the case and our knowledge of pathology alone furnish us the basis for saying that in the one case the consolidation is due to a tubercular deposit, and in the other to a simple inflammation.

The physical signs which we can appreciate by these two instruments may, in like manner, be due to many different anatomical conditions of the cerebro-spinal system.* The anæsthesias and partial paralyses that we take cognizance of by their aid, like the peculiar sounds heard with the stethoscope, are not specific of any particular morbid process, but simply denote a certain amount of cerebral impairment. In cerebral as in pulmonary diagnosis, we are compelled ultimately to appeal to the clinical history and pathology of a case before we can pronounce an opinion as to its nature, it matters not how much information physical signs may afford as to the situation and extent of the morbid process.

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* Vance: "The Early Symptoms of Cerebral Disease."—*Michigan University Medical Journal*, July, 1871.

For some time past, I have recorded many observations in which I have employed these instruments for the purpose of determining the comparative sensibility and motor power of the two sides of the body in individuals who were entirely free from cerebral disease. My object has been to construct a basis from which it would be safe to start in the more accurate investigation of the physical signs presented in those cases of brain disease which were passing under my observation. The results obtained can be summarized by saying that, while well-marked differences exist in the muscular power of the two sides, which, as we should readily imagine, is most developed on the *right* side of the body, the sensibility of the integument is nearly alike at similar situations on the two lateral halves of the body, the difference, where such exists, being in favor of the *left* side. The general rule is, that, while motor power, as determined by the dynamometer, is greater on the right side by about one-sixth, the power of appreciating differences of contact, as determined by the æsthesiometer, is greater on the left side in about the same proportion. An example will illustrate this: An individual can mark 30° with the dynamometer when compressed with the left hand, but when used with the right the needle indicates 35. In this case, the relative difference in strength is indicated by the difference between the markings obtained by the two hands—the right exceeds the left 5°. When the æsthesiometer is employed, it is found that, while the points of the instrument separated to the extent of ten lines are appreciated as two separate and distinct points when applied to the left hand, they will have to be opened at least two lines further to produce the same sensation at a corresponding part of the right hand. In other words, in this case—and it is a fair illustration of all such examinations in health—the sensibility of the left side exceeds that of the right in about the same proportion that the muscular power of the latter exceeds that of the former.

From this it will be seen that the differences between the two sides, although so great as to prevent accurate results being obtained by the use of either instrument singly, yet, when they are employed conjointly, mutually neutralize each other. The excess of sensibility on the left side is counterbalanced by the greater muscular power of the right side, and *vice versâ*. I have not had sufficient opportunities for observation with left-handed individuals to permit me to state what the rule is in such cases. For all practical purposes, we may call the nervous endowments of the two sides alike in health, and from this basis make our observations in disease.

The pathological process which, in the majority of cases, precedes the development of apoplectic symptoms, is due to an altered relation between the tissues and the blood. With the exception of cases of embolism, it is probable that some condition of this kind is present in all cases of apoplexy. Whatever the essential nature of this process may be, the state of the cerebral circulation is, beyond all doubt, a factor of the utmost importance. This varies in different cases from well-marked anæmia to extreme hyperæmia. Although the symptoms experienced may be similar in both class of cases, yet the treatment required in each is widely different.

The symptoms which precede an apoplectic attack vary widely in different cases. The presence of certain of these symptoms at one time, and their absence at another, are doubtless due to the increase and diminution of this pathological process within given areas of the brain-substance. To the fact that in the one case the sensory tract may be implicated alone, while in others this process may invade the motor tract or the supreme centres, are due those curious cases in which the premonitory symptoms may be limited to disorders of sensibility, motion, or intellection alone. This process, again, may be so generally distributed as to affect all those centres to an equal degree, in which case the symptoms will partake of all these different characters.

Whatever the character of the symptoms produced, whether limited to the intellectual faculties or generally diffused over the sensory or motor powers of the individual, it is a matter of the utmost importance to determine the condition of the encephalic organs, and to adopt proper treatment. The difficulties of sleep and dreams; the illusions and hallucinations of sight, hearing, touch, taste, and smell; the faltering voice and feeble limbs, as well as the confusion of thought, vertigo, headache, and actual delusions which these cases present, are due to cerebral conditions which our instruments enable us to appreciate, and which our remedies can control. To recapitulate:

1. The thermometer indicates local variations of temperature. In some cases of nervous disorder, Dr. Brown-Séquard says that the difference between the two sides may exceed 12°.

2. The dynamometer registers the comparative strength of the two sides, and in cases of disease determines the side of the brain in which it exists with the greatest intensity.

3. In like manner, the æsthesiometer indicates the comparative sensibility of the two lateral halves of the body, and affords like information as to the site of the cerebral disease.

4. The ophthalmoscope enables us to demonstrate the condition of the cerebral circulation, and thus to discover the immediate cause of the brain symptoms. In the vast majority of cases, this will be a state of hyperæmia. In some, however, anæmia will be the cause. In certain cases, local extravasations of blood can be seen in the retinal structures, together with very intense congestion. Should organic disease be present, it, in the majority of instances, will be indicated by structural changes in the optic disc of the side on which it exists.

124 East 27th Street, New York City.

INSANITY:

Its Dependence

ON

PHYSICAL DISEASE.

With compliments of
JOHN P. GRAY.

READ BEFORE THE MEDICAL SOCIETY OF THE STATE OF NEW YORK, AT ITS ANNUAL MEETING, FEBRUARY, 1871,

BY JOHN P. GRAY, M. D.,

SUPERINTENDENT OF THE NEW YORK STATE LUNATIC ASYLUM.

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INSANITY: ITS DEPENDENCE
ON
PHYSICAL DISEASE.

Since my connection with the Asylum, now over twenty years, I have endeavored to direct my attention and study, as far as possible, to the investigation of the causes of insanity, and the observation of the progress of the disease while under treatment. I early observed that in those cases of which full and reliable information could be obtained, the physical cause was generally found: that some change in some part or parts of the organism preceded the earliest manifestations of mental disturbance: that in those cases, some diseased condition of the body, outside of the brain, generally preceded the cerebral symptoms and the consequent insanity. In my official report for 1863, I presented this subject, with the intention of showing, from the recorded cases in this institution the relation, numerically, where moral and physical causes had been attributed as the influence determining the insanity. I there presented a tabulated statement embracing the assigned causation, in all cases admitted up to to that date, with comments,—assigning as moral causes those acting through the emotions, sentiments, passions, and affections; as physical, those producing their effects through physical impairment, diseases or injuries. In 1843, Dr. Brigham says, "with Pinel, Esquirol, and Georget, we believe that moral causes are far more operative than physical." In his first report he assigns moral causes in 128 cases; physical causes in 93 cases; unknown and doubtful in 55 cases.

Of the moral causes 50 are attributed to religious anxiety. I then expressed my conviction that more careful observation would reveal physical causes as productive of more insanity than moral causes, and that religious excitement and anxiety had but slight influence in this direction. The annexed table embraces the analysis of causation, moral and physical, in all cases admitted up to this date.

I then expressed the following views on this subject:

"Here we have a gradual and marked decrease in moral, and increase in physical causes. This is neither accident nor design. It results from experience and recorded facts. Insanity, for many centuries, was not recognized as a disease; but as a moral state, and in some a spiritual or demoniacal possession, and influenced by the moon. Many of the older medical authorities refer to and describe demonomania as a form of mental disease. The disenthrallment of the professional, as well as the public mind, on this subject, has been slow and gradual. However, we have similar ignorance and superstition in other fields of medical research.

"The question of the causation of insanity, is one of the most important with which we have to deal. If insanity is immediately developed from religious anxiety, excessive application to study, or giving way to the emotions of grief or joy, from the intoxication of success or from disappointed ambition, society must be guarded and admonished in those directions, and the treatment of persons insane from these causes must be such as to meet successfully the ever present causative influence. If, however, those apparently suffering from profound religious depression, or from the other moral causes named, are ascertained to be so affected because of certain bodily conditions, the successful means of treatment will be very different. If we find that insanity is dependent on causes which tend to depress the vital forces, and we discover these causes, we approach the question of the control of the disease and its limitation. If we find these causes, instead of subtle, moral influences, mainly physical, we advance still further toward control and limitation, as the latter are more within the power of individuals and of the profession, than the former. Think of having, within a single year, fifty persons whom you believe to be insane from religious anxiety, and those from all Christian denominations. What a store of theological knowledge the physician must possess, and what subtlety of reasoning to meet all these cases. This number was attributed to this cause the first year, twelve to excessive study, and fourteen to fright, disappointed ambition, political excitement, and jealousy.

These and kindred causes were recognized less and less as efficient influences in the production of disease, in the lifetime of Dr. Brigham, under the light of experience. The first year religious anxiety represented, in the table of causes, eighteen and 15-100 per cent., the second year nine and 81-100 per cent., the third year eight and 15-100 per cent., the fourth year five and 92-100 per cent., the fifth year seven and 22-100 per cent., and the sixth year (the last report made by Dr. Brigham,) six and 40-100 per cent. There was also equally marked diminution in other supposed moral causes, and increase in physical. Thus we perceive that more extended experience, and more careful observation of these cases, revealed the existence of disordered physical health as the efficient cause of insanity, and the religious depression, or other moral manifestations, as only exciting causes, or as incidental effects. This established, was an important advance. Rest, nutrition, medication, could then be presented, in truth, as the relief of sorrow. The decrease of religious anxiety, as an attributed cause of insanity, has therefore not been because people have been more or less religious at one period than another, or that new religious views have in the meantime been advanced. It is simply because of the steady progress of medical knowledge, deduced from patient investigation, intelligent observation, and careful analysis of facts. Upon this point, then, what have we practically gained? These cases, thus understood, may be properly inquired into by spiritual as well as medical advisers, through their physical condition, and the sufferers themselves, especially in the earlier stages of melancholia, (the form of mental disease of which religious depression is so often an accompaniment,) will, when assured that their supreme unhappiness is but reflected from their physical depression, be more likely to understand their condition, and to appreciate and acquiesce in the necessary remedies for their restoration. Again, what an amount of anguish among friends is removed by the knowledge that this depressed state and awful sense of sin and guilt, of being forsaken of God and man, is indeed only a cloud without wind or rain—a weary, darkened spirit from weakness of the flesh—a shadow which will be dissipated on returning health, as the sun chases away the night by his coming.

The solution of cases, under this cause, is the solution of causation in melancholia in general, and of many cases, under other forms of mental disease, supposed to be dependent on moral causes, especially jealousy, suspicion, grief, excessive study, and kindred influences. I have too frequently witnessed these supposed troubles vanish under returning health to doubt on this matter. To discover, then, under such supposed moral causes, that the true source of disease lies in physical disorders, is equivalent to substituting rest, sleep, food and medication for moral reasonings and difficult and vexed theological problems, and thus to bring the case within the range of medical skill. If these means will dispel the delusion of having committed the unpardonable sin, or of being turned into beasts or demons, and relieve and remove that general sense of intolerable misery which impels so many to attempt self-destruction, as the only possible means of relief, then the physician will feel hopeful in the labor before him. We indeed think it is safe to infer that religious anxiety is rarely if ever a cause of insanity. The sublime faith of Christianity is rather a safeguard against it, and is unquestionably a support under its scourging. We do not believe that insanity is produced by this cause directly, by a profound impression made through the sentiments and emotions upon the nervous system; or indirectly by gradually undermining the general health. It will hardly be argued that depression is a phase of religious experience. As a general thing, the most wretched melancholics are members of churches, and often are the most humble and exemplary. However, a full answer in our experience is in the fact that this class of patients are gradually relieved of all depression and anxiety as health returns, and free from it on its full restoration."

Investigation and clinical observation constantly strengthen the conviction that more careful inquiry into this subject, by a more searching examination in each case on admission, and more patient and exhaustive inquiry of friends, with more thorough record and sifting of clinical facts while the patient is under treatment, would reveal, in a larger number of cases, the real operative causes inducing insanity. Such inquiry must also tend to place study and treatment on a true foundation,—that is, of disease. Unfortunately, superstition and ignorance long prevented calm investigation, and stamped the disease, in general estimation, and, in a large measure, in the view of medical men, as one but little amenable to treatment, and as mainly a condition demanding custody for safety. And this state of things unhappily still exists to such a degree as greatly to embarrass inquiry, and can only be dissipated by such investigations as will place insanity in the category of nervous diseases, to be studied and treated as other bodily diseases.

The history of hospitals for the insane for many years past is an invincible argument in this direction.

Their transfer to the exclusive care and control of medical men; the increase of the medical staff of hospitals; the disuse of harsh and cruel means of restraint; the greater attention to medication, diet, ventilation, and all hygienic means; all indicate the subordination of custodial to medical considerations in the conduct of such establishments. *Post mortem* examinations have, in many cases, verified the assumed patholical causation, and revealed the consecutive changes in the progress of the disease and the relations of symptoms observed to these changes, in a sufficient number of cases, to justify and encourage more careful and exhaustive investigation. Besides, the advance in physiological and pathological anatomy, in the progress of medical science, offers constantly increased and more reliable means of prosecuting such inquiries. The special attention now given to the nervous system, by the most able observers, is a further inducement to push inquiry in every possible direction, but especially toward changes in the functions or organic structure of the nervous system, that can throw any light on the subject. Again, the vast number of insane, and the possible fact of increase of the disease beyond the ratio of the increase of population, makes it all the more important and imperative that no opportunity should be neglected which promises the least light or relief.

Two years ago I recommended the appointment of a special pathologist, that such investigations might be made as are demanded by the progress of medical science. The managers of the asylum responded to this recommendation, and the results were so satisfactory, that I felt fully justified in asking that the appointment should be made a permanent addition to the medical staff. The facts and reasons for this were contained in my last annual report. Before it was transmitted to the Legislature, the portion relating to pathological work was submitted to His Excellency, Govenor Hoffman, who, in his annual message, made the following recommendation:

> "In connection with the subject of insanity, I respectfully suggest that you will give favorable consideration to the application which will be made on behalf of the State Asylum at Utica, for authority to appoint a special pathologist for the duty of making such investigations as seem to be now demanded by medical science. The reason for this will be fully stated in the report of the superintendent of that institution, which will be transmitted to the Legislature."

A bill was passed by the Legislature authorizing the appointment of a pathologist, and Dr. E. R. Hun, who had filled the place for a year, was appointed. The course I suggested last year was to embrace—

> "*First.* Examination of secretions in all stages of the disease."
>
> "*Second.* The pulse under the sphygmograph to determine its force and character, and whether any, and if so, what co-incident relations its various phases may bear to physical states and psychological manifestations."
>
> "*Third.* The pulse under the sphygmograph to show the influence of medicines on the circulation."
>
> "*Fourth.* Examination with the ophthalmoscope to ascertain the relations of morbid changes in the optic nerve, vessels, &c., of the eye, to pathologic conditions of the brain and its membranes."
>
> "*Fifth.* The skin, its temperature, color, elasticity, sensibility, &c., in the several forms and stages of the disease."
>
> "*Sixth.* *Post mortem* appearances, generally, and microscopically."
>
> "*Seventh.* Photographic representations of morbid conditions and specimens."

The experience of another year has given no cause to change that course of investigation.

While experience shows that the morbid conditions of organs and tissues more frequently act on the brain than the converse, and thus disease of special organs, and general ill health from lowered vitality, precede and become the cause of the morbid state of the brain, ultimating in insanity; still there are cases where the general ill health and the insanity are due to an overworked brain, or the anxiety and prolonged tension and sleeplessness which are often the result of grief and pecuniary losses. Even here, however, the cause is physical, because insanity comes on only as a result of defective nutrition in the tissues, those of the brain included; the sleeplessness and deprivation of rest acting powerfully, not only against appetite and the simple ingestion of food, but also by wearying the nerve-tissues, and preventing ultimate cell nutrition. Thus some persons fail suddenly and rapidly, and die unexpectedly. We say these die of exhaustion. But they are not always emaciated, and thus exhausted. The brain gives way, fails in vital energy, and death ensues. Here the morbid action is not in the nature of shock,—of sudden arrest of heart-action by a sudden and powerful impression on the brain,—but of tension and wearing effort, steadily and powerfully depressing the vital energy.

We see constantly the influence of mental exercise and occupation on the health and growth of the brain. We recognize here the physiological law, that due exercise of an organ promotes its development and power. We recognize also a limit to this occupation, beyond which it is injurious. A child can not profitably, or consistently with health, occupy the brain beyond a certain number of hours without rest. If mental work is pushed too far in children, growth may be arrested and cerebral development also. A development in bodily size may proceed, but the structure may be delicate. It is unquestionably true, also, that many bright children, under attempts at over-education, exhaust the vital energy, and recuperative growth in brain-tissue is lowered, while the animal functions are carried on well. The boy developes a strong, well-proportioned body, but is dull. Many parents and teachers are thus disappointed. This law, which runs through growth, applies equally to maturity; however, with this difference, that in maturity excesses bear fruit always in disease. And it may be truly said that, as a rule, the brain is the last part of the organism to yield to disease, even under its own overwork and excesses. Says Dr. Gull, "the flatulent dyspepsia of the student, the tears of the distressed, the dry mouth of the anxious, and the jaundice of fright, daily remind us how far the cerebral influence extends."

In insanity, therefore, we have the dominating organ always deranged in function if not further. Whatever the cause may be, physical or mental, or whether the brain is primarily or secondarily affected, the condition in insanity is cerebral disease. Disease is what we have to deal with. Not disease of mind, for the mind, the spiritual principle, the immortal being, can not be the subject of disease. The manifestations of the mind are disturbed and disordered when the brain, which is its organ, suffers. How mind and body exist here together in harmony in health, is quite as inexplicable as their disturbed relations in disease. Inquiry may never be able to solve the mystery of the relation between thought and the physical organism. "This our faculties are incompetent either to decide or to discover, but this short-coming of man's intelligence affects neither his duties nor his hopes, neither his fears nor his aspirations." [*Rolleston.*]

The expression "disease of mind" should have a place in the nomenclature of modern medical science with witchcraft and demonomania. They are alike the offspring of metaphysical speculation, alike misinterpretations of phenomena. Plato and Hippocrates, in their day, respectively represented the metaphysical and medical aspects of this disorder of the brain. Plato considered insanity, on the whole, a blessing. "A sufficiently clear proof that the Deity assigned prophetic power to *human madness* is found in the fact that no one in his right senses has any concern with divinely inspired and true prophecy, which takes place only when the reasoning power is fettered by sleep, or alienated by disease or by enthusiasm." [*Timæus.*] Again: "The greatest blessings we have spring from madness, when granted by divine bounty. For the prophetess at Delphi, and the priestesses of Dodona have, when mad, done many and noble services for Greece, both privately and publicly; but in their sober senses little or nothing." [*Phædius.*] Says Hippocrates: "Men ought to know, that from nothing else but thence [the brain] come joys, despondency and lamentations. And by this, in an especial manner, we acquire wisdom and knowledge, and see and hear and know what are foul and what are fair, what are bad and what are good, what are sweet and what are unsavory; some we discriminate by habit, and some we perceive by their utility. By this we distinguish objects of relish and disrelish, according to the seasons; and the same things do not always please us. And by the same organ we become mad and delirious, and fears and terrors assail us, some by night and some by day; and dreams and untimely wanderings, and cares that are not suitable, and ignorance of present circumstances, desuetude and unskillfulness. *All these things we endure* from the brain when it is not healthy."

To the philosopher or metaphysician, insanity is what they may choose to make it. To one of the sublime faith of Plato, who referred all the phenomena of nature which he could not interpret to a divine power, it is not strange that insanity should seem to be from the gods. Others, from another stand-point, have considered it also supernatural, but have assigned the phenomena to the influence of devils. To Hippocrates, who was a patient, earnest physician, who, with wonderous success, studied morbid phenomena, insanity was from an "unhealthy" brain. To others, again, to whom faith is not given to believe more than they can see and understand, or who do not choose to believe more, mind and all mental phenomena are mere physical results: mental manifestations of whatever order, hopes, fears, joys, sorrows, immortal longings, deep affections, are, like hunger and thirst and pain, but expressions of a physical organization; the restless mind of man, instead of being all we believe of it, an immortal spirit manifesting itself in this life and in this body, preparing for a life to come, and using the brain as an organ or instrument for its purposes, is a mere secretion of the brain, depending on its existence, and sickening and dying with it. Are we to account for anger, rage, jealousy, grief, and all the violent manifestations of the passions, as physiological states or disturbances of "brain secretions?" In physiology, causes and results must bear a uniform relation; and we should have for so much grief so many tears, for so much provocation so much anger, and the like. Instead of having varied manifestations in the same individual, as well as in different individuals, from the same causes, the manifestations should be uniform. Cabanis, who wrote nearly a century ago, expressed the materialistic theory thus:

> "To obtain a true idea of the operations by which thought is eliminated, the brain must be considered as a particular organ, especially designed for its production; even as the stomach and intestines for carrying on digestion, the liver for secreting the bile, the parotid and maxillary and sublingual glands for the preparation of the salivary secretions.
>
> "Impressions, on reaching the brain, stimulate it into activity; as aliments, being introduced into the stomach, excite it to a more abundant secretion of the gastric juices, and to those movements which favor their proper assimilation. The natural function of the one is to receive every individual impression, to attach to it certain indices, to combine the different impressions, to compare them among themselves, to draw from them certain judgments and determinations; as the function of the other is to act upon nutritive substances, whose presence stimulates it, to dissolve them, and to assimilate their juices to our nature.
>
> "If it be said that the organic movements by which the functions of the brain are executed are unknown to us, it may be replied that the action by which the nerves of the stomach determine the different operations constituting digestion, the manner in which they impregnate the gastric juices with the most active dissolving power, do not disclose themselves more to our researches! We see the aliments pass into the viscus, with new qualities, and we conclude that it has really caused them to undergo this alteration. We equally see impressions arise to the brain through the medium of the nerves; they are then isolated and without coherence. The viscus enters into action; it acts upon them, and soon it evolves them transformed into ideas, of which the language of physiognomy and of gesture, or the signs of speech or writing, are the

outward manifestations. We conclude with the same certainty that the brain in some manner digests the impressions; that it produces organically the secretion of thought.

This, then, fully resolves the difficulty raised by those who, regarding sensation as a passive faculty, do not understand how the acts of judging, reasoning, imagining, should be nothing else but perceiving. This difficulty vanishes, when we recognize, in all these different operations, only the action of the brain upon the impressions which are transmitted to it.

"But if, moreover, we observe that the movement, of which every action of the organs presupposes the existence, is in the animal economy only a modification,—a transformation,—of sensation, we shall see that we are excused from making any changes in the doctrine of the modern analysts, and that all the physiological or moral phenomena are always brought back, in the last result, to the faculty of sensation." [Cabanis, *Rapports du Physique et du Moral de l' homme*, vol. i, p., 124.]

Recently Dr. W. A. Hammond, of New York, in a work on "*Sleep, and its Derangements*," has reasserted this old theory, and expresses his views of mind in the following language:

"Writers who contend for the doctrine of constant mental activity, regard the brain as the organ or tool of the mind; a structure which the mind makes use of in order to manifest itself. Such a theory is certain to lead them into difficulties, and is contrary to all the teaching of physiology. The full discussion of this question would be out of place here; I will, therefore, only state that this work is written from the stand-point of regarding the mind as nothing more than the result of cerebral action. Just as a good liver secretes good bile, a good candle gives good light, and good coal a good fire, so does a good brain give a good mind. When the brain is quiescent there is no mind."

It will thus be seen that the introduction of materialistic theories, even into the domain of psychology, is nothing new. Neither is Cabanis the only French writer who has pushed Locke's theory of sensation to its ultimate results of materialism and atheism But it would be a thing much to be deprecated, that the generous and catholic spirit of modern scientific investigation should be narrowed and hindered by an attempt to revive the exploded vagaries of the French materialism of the encyclopedists and the Revolution. The best writers of the present day, however, if they refuse to bend the conclusions of science in the interests of religion, on the other hand will much less consent to commit science to a purely conjectural theory, which militates against moral order and social welfare no less than against the common sense of mankind.

We do not look at mind from the stand-point of regarding it "as nothing more than the result of cerebral action," and therefore as a material substance, a mere secretion liable to disease and death. We regard the brain as the organ of the mind, and we cannot perceive that such a theory conflicts with physiology or is contrary to its teachings. If the mind is a material substance, a secretion of the brain, as bile is a secretion of the liver, then the sublime faith of the Christian religion is of little consequence to man, and they who work for the advancement of medical science truly labor in vain. If, however, this body is what Revelation declares it to be, (the temple of the mind or spirit which in it dwells, awaiting a life to come,) and what science shows it to be, a living organism, *under definite laws*, then it is worth our care, as the dwelling-place of an immortal being.

Says Dr. Acland, in an address at Oxford, before the Medical Association of Great Britain and Ireland, when taking the chair as President,—"The physician sees in the body of man the material structure by which alone the known operations of the mind of man are possible in this world, the organs by which alone he can work his earthly work, whether it be the work which he shares in common with the beasts of the field, or the work through which he can enter into conscious relation to his unapproachable Creator: the frame by which, while bound down in an earthly charnel-house, he lifts his eyes and strains his heart with yearnings ineffable towards a higher nature, and obeys the upward-tending impulses of affections strong unto death, affections so pure and so divine as to lose in the love of others even the consciousness of self."

We do not believe that mental phenomena can be accounted for by physiology, much less that the teachings of physiology necessitate or even lead to materialism.

Professor Rolleston, who stands in the foremost rank of teachers in Physiology, uses this emphatic language:

"The Physiologist as such has nothing to do with the data of psychology, which do not admit of being weighed or measured, nor of having their force expressed in inches or ounces." Psychical manifestations, mental phenomena, he declares to be "facts in just as true a sense as any which scalpel or callipers, which weights or measures, can disclose;" and holds "that our higher and diviner life is not a mere result of the abundance of our (brain) convolutions." And again: "I believe, however, that, if men would take as much and the same care in these psychological questions as the physiologist does in his experiments and observations, to overlook none of the conditions and circumstances of the entire complex of phenomena upon which they undertake to decide, they would come to see that alone, and often behind, but always beside and even beyond the whirl of his emotions and the smoothly fitting and rapidly playing machinery of his ratiocinative and other mental faculties, there stands for each man a single undecomposable something—to wit, himself. This something lives in his consciousness, moves in his will, and knows that for the employment and working of the entire apparatus of feelings and reasonings, it is individually and indivisibly responsible. Its utterances have but a still small voice, and the turmoil and noise of its own machinery may, even while working healthily, entirely mask and overwhelm them. But if we withdraw ourselves from time to time out of the smoke and tarnish of the furnace, we can hear plainly enough that, howsoever the engine may have come together, and with its present being, the *engineer*, at all events, is no result of any process of accretion and agglomeration. Science, business, and pleasure are but correlations of the machinery in its different applications and activities; *we* are something beside all this, manifesting ourselves to others in the decisions of our *will*, and manifesting ourselves to ourselves in our aspirations and consciousness of responsibilities."

Says Mr. Herbert Spencer: "It may be safely affirmed that physiology, which is an interpretation of the physical processes which go on in organisms in terms known to natural science, ceases to be physiology when it imports into its interpretations any psychical factor, a factor which no physical research whatever can disclose or identify, or get the remotest glimpse of."

Prof. Lionel S. Beale says: "Every one will admit that the nerve-tissue of the brain is the instrument through which alone thinking power works and mind acts." He subsequently thus disposes of the materalistic theory of mind:

"Some have looked upon brain as a sort of gland by which thoughts and ideas are formed or secreted, as if thought, which can neither be touched, weighed, measured, or in any way physically estimated, was a thing allied to the bile, the saliva, or the gastric juice, which are material substances, and can be analyzed and otherwise experimentally studied. It would not be more unreasonable to maintain design or will to be a part of the material framework of the organism, than to assert that mind, like certain kinds of matter, is secreted. Thought is no more material than that peculiar capacity which makes living matter of a certain kind at length become oak, cabbage, dog, man, etc. Nay, it is further removed from the material, for while this property or power influences the very particles of matter, and makes them take up certain fixed and definite positions, thought only produces a sort of evanescent vibration, which results in the expression of ideas which are themselves as immaterial as the thought itself.

"Mental energy has been regarded as the *function* of the brain, but if it be so, it is a *function* of a very different order from that discharged by other organs. *Function* implies an act in which will, purpose, design, are not concerned, and in which material changes can be proved to take place. The function of a gland is to produce a secretion. Certain conditions necessitate the production of this or that particular secretion, which may vary to some extent, according as the conditions are changed. The function of a muscle is to contract and become relaxed, but the material change only occurs in definite directions, necessitated by the structure of the instrument and the force which acts upon it. The exercise of choice is neither possible nor conceivable. So, too, with reference to the function of nerves. These transmit currents. The paths which the currents are to traverse having been determined and formed, the currents are developed and transmitted along the nerves.

"But the *function* of the organ of the mind is an operation very different from any of these. Its great characteristic is choice—selective capacity. If the cells of the liver chose for themselves whether they would secrete bile or not, or determined the kind of bile to be secreted, or the bile chose for itself by which ducts it should pass, whether it should flow quickly, slowly, or not at all; if the muscle contracted now in one part and now in another, according as it willed—if it elected to contract in one direction, and then in a different one; if the nerve cells decided among themselves which should produce current and which not; if the current chose to run along one fibre at one time and then along another, according to the object it had in view—then, but only then, as it seems to me, could mental activity be regarded as in any way analogous to the function of an organ or of a tissue. To look upon mental action as a mere function of the brain is a fundamental error, and unpardonable in those who have really studied the structure and action of secreting organs and nerve organs.

"Mental activity may rather be compared to that marvellous power, property or force, which enables the liver cell to *form* what we call bile, which renders possible that change in shape of the ultimate particles of muscle which gives rise to contraction, and determines the change in the ultimate molecules of nerve matter upon which the current depends; but this power is not the function; it is that which alone renders function possible. But even this comparison is not a true one, for the power above referred to acts as if it were of some necessity, while the remarkable characteristic of mental action is freedom of choice. Certain conditions given, the liver cell *must* form bile, the muscle *must* contract, the nerve cell *must* give rise to, and the nerve fibre *must* transmit, the current; but is it conceivable that under certain conditions actual or supposed, the brain *must* think? Is what I am now writing but the result of the distribution of a little extra proportion of certain nutrient constituents and oxygen to my nerve cells, which thereby compels me to say all these things? Have I no choice?—*must* I say all this, and in the precise way in which it is here said? All these things would surely have been said in a far better and more perfect manner if the ideas had been formed like a secretion by a gland, independently of experience and without any efforts of my own. All our glands perform their work perfectly when their formation is complete. They require no teaching, and they work without effort. There is nothing in the action of a gland which at all corresponds to the improvement in capacity resulting from exercise, which is so remarkable in the case of cerebral nervous action. The general tissues and organs at least of those persons who have reached or passed middle age, performed their functions some years ago as well as, and I fear in some respects even better than they do now. *Will* has exerted, and can exert, no direct influence. But it is very different in regard to the organ of the mind and the the tissues concerned in intellectual action. Every one knows that the degree of perfection which that has attained, or will attain, is determined in great measure by his own efforts—by his own will.

The thinking instrument of one individual is not capable of being perfected in the same degree as that of another, but it is quite certain that each may be improved and made to work more perfectly, if its possessor determines that this shall be; nay, I think I may say, if he will not interfere actively to prevent its improvement; for the natural tendency of the mind is to exercise itself, and, in doing so, the instrument, which it directs, necessarily improves. As the mechanism becomes more perfect, the pleasure afforded by its working becomes greater, and to real desire and sustained effort on the part of the mind soon succeeds improvement in the structure of the healthy instrument by which the attainment of the end desired is rendered possible." [*Med. Times and Gazette.*]

Dr. Thomas Hun, in an article in the AMERICAN JOURNAL OF INSANITY, in 1846, on the "*Relations of Physiology to Psychology,*" says: "Some have denied the existence of mind, and have made thought an attribute of the substance of matter. These are the materialists. Others have made matter only a mode of manifestation of mind. These are spiritualists. While a third class have endeavored to find a third term which should include both matter and mind." These classes have been denominated Somatists, Psychists, and Somato-Psychists. Under either theory of investigation, Dr. Hun, at that early day declared it impracticable to advance in psychology, and experience has verified this, as shown by the declarations of Rolleston, Spencer, and Beale. "We have to study," says Dr. Hun, "not the nature of the two substances, nor the nature of their relations, but this relation itself as it manifests itself to the senses and to consciousness. The great questions for us to answer are these: what nerve movements correspond to given mental acts? what is the mechanism of these movements? and how are the mental acts affected by changes in the nervous matter in the rest of the body? . . . . Physiology is a science of facts cognizable to the five senses, and uses the same modes of investigation as the other physical sciences. Psychology is the science of mind. It is founded on facts of consciousness which are not cognizable to the senses. It embraces all the mental operations, which are very different from changes in nervous matter, and hence psychology is not merely a chapter of physiology, but a separate and independent science."

To sum up this whole subject, there are to be observed two prominent and vitally important points, which, to our mind, demonstrate the utter falsity and even impracticability of the materialistic theory of mind. One is *spontaneity;* the other, *responsibility.* The idea or notion of spontaneity we know to be a reality of our own consciousness, as patent and demonstrable as any fact of science, and yet, to use the precise and clear-cut scientific language of Herbert Spencer, it is impossible to make this spontaneity a "factor" in any mere natural or physical process whatever. Our very conception of the material altogether forbids it. Even in that last step where physical science approaches nearest the domain of metaphysics, the attempt to arrive at some definition of Force itself, the idea of spontaneity is by no means begun to be reached, or in any way involved. When it comes to that, it comes to God himself, whatever man may choose to name Him, "Jehovah, Jove, or Lord."

The other point, which is the notion of moral responsibility, is one remove further even than spontaneity, from all conception of the material and therefore much less reducible to any physical or material process. It would be as easy to deny *in toto* intellectual phenomena as to deny the reality of our idea of moral responsibility; but the notion of responsibility itself is a direct contradiction of the idea which arises out of such a thing as physiological secretion, or any other mere process of nature governed by definite and unchangeable laws. It would be impossible to connect the two, or in Herbert Spencer's phrase, to make them coördinate "factors" in any intelligible result whatever. Whatever the animus of such a position may be, the result must be the getting rid of the idea of moral responsibility altogether. Science of this kind, instead of being a blessing to the world, would contribute only to anarchy and moral disorder, even if it did not utterly destroy the self-respect of any one who should profess himself proficient in it.

Science needs neither doubt nor skepticism as a condition for her advancement. Her aim is to discover and read the laws and processes of nature herself, imprinted by the Creator, and she works, to use the language of Bacon, "Keeping the eye steadily fixed upon the facts of nature, and so seeing their images simply as they are." We believe that physiological science will so advance that every process in the complex phenomena of physical life, in health and disease, shall be read and revealed and understood.

The true and only method by which insanity can be studied is that followed in all other diseases. The physical lesions are the subjects of primary importance. These must be studied through physiology and pathology. The mental manifestations are here secondary and dependent. "Organs and tissues," says Dr. Gull, "have each their own life, and correlative with it, their own tendencies to disease, and their specific power and mode of repair," and "the purpose of our study is to trace these tendencies to their source on the one hand, and to their effects on the other."

We say that insanity is a bodily disorder; that it is a disease of the brain. This does not imply that there is something to be thrown off, in the character of some morbid entity. It simply means that certain changes have taken place in the brain, or its investing membranes, which imply a departure from healthy physiological action, and that in consequence of these changes there is more or less prolonged disturbance of the mind. The physician recognizes the delirium of fever, and refers its origin to the brain. The convulsions of infancy and childhood, from the presence of worms in the intestines, or indigestible materials in the stomach, or the process of teething, he refers to the brain. In the former, he may refer the remote cause to some poison; but the immediate cause is a tissue-change. If this change is gone through with within certain limits, he looks for recovery; if not, under further tissue-change, the patient sinks and dies. The remote or predisposing cause of the latter he calls morbid irritation. If the stomach and bowels are emptied of the offending matters, and the irritation of teething relieved before tissue-changes follow the convulsions, recovery will take place. In other words, if the constitutional disturbance of the nervous system, in the one case, from poison, and the local disturbance of the nervous system in the other, from irritation, may be relieved before certain organic changes occur, recovery takes place; if not, partial recovery, or death, results.

If the carotid arteries are pressed upon by a tumor, or the circulation of the brain interfered with by aneurism, we have what is denominated a hyperæmic state of the brain; not a determination of blood to the brain, but the blood detained by the vessels dilated. Clinical study and physiology have taught us to anticipate the resulting consequences of such a state. The physician is not surprised to find insanity follow; but this is the exceptional result. He is quite as likely to find failure of the general health, from feeble action of the heart, due to the condition of the brain. Again we have an anæmic or bloodless condition of the brain from copious hemorrhage after childbirth, or from other causes, and general enfeeblement results, or convulsions, delirium, or insanity may follow. Can we, by careful clinical observation, ever be able to determine why one should result, instead of the other? or why we may have in such a case—convulsions, then delirium, and afterwards insanity? Can we hope to answer these questions, without the aid of pathological investigations, made *post mortem?* We may be satisfied to reply that convulsion follows hemorrhage, under the physiological law that muscular spasm supervenes upon sudden and copious loss of blood, because muscular irritability is thus increased, and that the pathological state is one of depressed vital energy, and here we have a clue to treatment. Delirium following convulsion, or following the hemorrhage without convulsion, we may also explain under physiological and pathological laws.

Now should we stop inquiry here, when insanity results? Can we admit that insanity is anything more or less than a pathological condition, or that it lies beyond the boundaries of ordinary and legitimate medical study, and beyond the range of clinical observation or pathological investigation? Will not the patient study which elucidates one be likely to elucidate the other? But in the latter the mind is affected? So is it in delirium. So is it, in a degree, in its operations, in all diseases, when the brain is in any way involved. So is it, when the brain is under the influence of alcohol, or certain drugs. In all abnormal conditions of the brain, however induced, we have a degree of disturbance in mental operations. At a certain stage of intoxication, there is consciousness of the fact, and full control and direction of mental operations; at another stage, the brain, the instrument or organ of the mind, as we believe, is so overwhelmed that it cannot be used. We recognize in all these conditions simply physical disturbance, either physiological or pathological. A proper regard for the teachings of physiology does not require that, in the last condition mentioned, when the brain is "quiescent," we must conclude that "there is no mind." On the other hand, it will not be argued, that, in these conditions of mental disturbance, there can be either a physiological or pathological state of *mind* itself! We do not *treat* these mental phenomena; but we regard them simply as exponents of physical states. We hold that it is not necessary, in order to establish the physical origin and nature of insanity, or other cerebral diseases, to show that every case is of such origin and nature. If, in a single case, insanity is shown to come on as the result of well-recognized bodily disease, and the mental disturbance disappears *pari passu* with the physical restoration, the argument is invincible.

We do not treat the mental phenomena which appear, as indices of the cerebral disorder; but we point out to the patient his changed mental condition, and endeavor to show him that his delirious conceptions are delusions, and result from the morbid condition of his brain; and that with restoration to health these delusions and misconceptions will vanish. Many may be convinced of this; and though the delusions do not disappear with this conviction, yet persons may, and often do, so far keep constantly in mind their true condition, and exercise such control as largely promotes their recovery. The mind, by this effort, uses the brain; and, by the exercise of its legitimate dominating power, moderates its action in some directions, and increases it in others. The mind "exercises choice," and controls itself, and by limiting and modifying its use of its organ, the brain, aids in the restoration of that organ. In many instances people recognize the approach of insanity in themselves,—not simply from vague and unusual sensations as pains in the head, sleeplessness, etc.,—but recognize a marked change in their way of thinking, feeling, and acting; a change which not only does not commend itself to their judgment, but is also against and repugnant to their wishes and desires. Under such states of mind persons come to the asylum for advice; and since my connection with it, a number have come thus alone, and insisted on admission. I have mentioned some of these cases in my reports. In one instance, the person made application himself to the county judge, obtained an order for his admission, and brought it himself. Another case was that of a woman who came from a distant part of the State, and informed me that she had left home in the night, without the knowledge of her family, because they did not believe she was insane, and would not assent to her coming to the asylum: asked me to telegraph her arrival to her family, and write and explain to them her case. She then stated to me how delusions developed while she was watching over an invalid mother; that she recognized the delusions, as such, but as she failed in health was unable to do so at all times, and therefore felt she must be getting insane. She remained, and after a time passed into a state of acute mania, and, when apparently recovering, committed suicide.

Another case was that of a young girl. She for some time observed in herself periods of mental depression and exaltation: after a time strong suicidal suggestions came during the periods of depression, and during those of exaltation, an idea that she was destined for some great work in the church. She thought she might be insane. Her health, never robust, was gradually failing. She left home in the night to drown herself in the canal, but on reaching it she was quite chilled, the night being cool. She then thought her changed condition might possibly after all be insanity, and not the despair of a lost soul. She therefore resolved to come to the asylum, and state her case, and then, if she were insane, try and get well; and if not considered insane, end an existence which to her seemed only an injury to the world. She first stated her case, and when told she was insane, related the circumstances above, which were verified. She actually walked into the water. She remained in the asylum, passed into deeper melancholia, and then became demented, and finally recovered. Both these women were feeble and anæmic, the blood lessened in quantity, and depreciated in quality.

I could present, from my recorded experience, a number of such illustrations, showing the appreciation of insanity and the dominating power of mind. In the wards of the asylum this is a daily experience. Patients not only recognize that they are insane, but make every effort at control; and many take food and exercise,—to both of which they feel the extremest repugnance,—simply as a duty, and stimulated by the hope of recovery *held* out to them, and which hope they only faintly grasp. While writing I am interrupted by the admission of two cases, a man and woman. The friends and physician of the man represent the case as a recent one, dating but a few weeks back to some eccentric conduct; and declare the case as somewhat remarkable, because they can find no cause for the insanity. Yet a careful examination shows that the man has been steadily breaking down in general health for two years. That he is generally anæmic, and has cerebral anæmia to such a degree that his pupils are not only enormously dilated, but scarcely contract at all under the influence of light. He has hallucinations of sight and hearing, from this condition. He moves about the office like a man half dreaming: admits he is sick, but does not see why he should be called crazy. When asked how he reconciles certain conduct with sanity, says he never was guilty of it. When all the circumstances are related to him, he replies, "I have some recollection of that, but I do not know why I did it." He has great muscular languor, has passed the period of cerebral excitement, and is dementing.

The woman denies her insanity. Says she is a great magnetic healer; has received the baptism of the Holy Ghost, and unction from God; that her mind has been illuminated so that she understands science, because it is revealed to her; that she will let the world know this change, and intends to speak in Mechanics' Hall, in Utica, and show what true religion is, and what magnetic healing is. She admits she has not been well for months, and has suffered from intense headaches; but claims she is now well, better than she has been for years. She is incoherent in conversation, exalted in her ideas, disdainful in manner, indignant at being called insane, threatens the consequences of confining such a person as she is. Her muscles are tense. She moves about the office with great muscular firmness, and spasmodically closes her hands and compresses her lips. She is anæmic, almost colorless. Her pupils are greatly dilated; her gums and tongue are pale. Although she is indignant, angry, her emotions wrought up to a high point, and she is on the verge of maniacal raving, she does not change color. This woman's whole appearance, conduct, and manner of speech, are in direct contrast with her character in health. The anæmic state of the brain is the cause of the insanity. The muscular system is in a state of abnormal activity, "a neuropathology from the brain to the tissues." This patient has good appetite and digestion, and says she is free from all pains or uncomfortable sensations. Has this woman disease, as that term is ordinarily used and understood in medicine, or is the brain, in the language of materialism, "secreting force"* of abnormal quality? We say, the mental phenomena are due to the anæmic condition of the brain. This woman has a large active brain, and it dominates over the whole organism, in its present state. While she is really in a state of debility, the brain exercises power over the voluntary muscles quite as fully in this state of irritation, with a pulse under 80, as it would in the vascular activity of fever delirium, with a pulse over 100. However, the cause to be truly assigned in these cases, is the generally depressed health, inducing the anæmic state of the brain, and nervous system. Both these cases are brought to the asylum as soon as the insanity is recognized, as both are surrounded by intelligent friends, and have conscientious phycicians. The former of these cases might have been treated at home, if his physician had received the same degree of instruction in regard to insanity that he did in regard to apoplexy, paralysis, and other disorders of the brain and nervous system. In contrast with this prompt action in securing treatment, is the unfortunate delay in the vast majority of cases until the period of recovery is past. Such fatal delay has characterized more than half of the 480 admitted to the State asylum this year. Many of those received have not only suffered from delay, but from injudicious, though well-intended treatment. Cases of melancholia from over-work, and the gradual failure of the tissues from age, and the consequent lowered vital energy, have been bled, blistered, setoned, and purged. Old ulcers, which nature had kindly healed for years, re-opened afresh,—all under the vague general idea of counter-irritation, and this when irritation from deficient and impoverished blood was a persistent pathologic state. In one case,—a feeble, old, melancholic women,—"a mercurial, alterative course," was added, producing salivation.

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* The mind of man may be defined as a force developed by nervous action.—*Journal of Psychological Medicine*, July, 1870.

Without raising the question as to how far we have advanced in the recognition of the physical symptoms of insanity; or how far we are able to diagnosticate the disease by physical signs; or how far we should be able to verify a state of mind, claimed as insanity by the physical indications present; or how far we should be required, in examining criminal cases, in testing possible or probable feigning, to adduce physical signs in evidence; we may truly say, that only through pathology can we hope to advance in diagnosis. It is not necessary, for success in this direction, that we should attempt the study of the manner in which the spiritual being is associated with the animal existence, or to define the mysterious mutual relation and influences between them. It is sufficient that we should study the morbid or disordered states of body which are competent to induce such changes in the brain as cause that altered or delusional mental state denominated insanity; and the physical signs which indicate the existence and progress of such brain changes.

It may be safely assumed that experience has given us some fundamental starting points:—

1st. Disease of any part of the organism may be the pathologic cause of insanity.

2d. In such cases insanity is not manifested until the brain is actually involved.

3d. Disease of the brain or its membranes may be the primary, exciting cause of insanity, and other parts of the organism subsequently become affected.

4th. Insanity more frequently has its primary origin in pathologic states outside the brain, than in primary diseases of the brain.

5th. There are physical symptoms and signs of brain diseases, which experience has enabled us to recognize as pathognostic of certain brain-changes; by knowledge of which we are able to anticipate and understand the progress of cerebral diseases.

While we may admit that, in a given morbid condition of the brain and system generally, the treatment would be the same whether the brain or other parts of the organism were first affected, it is nevertheless of the highest importance to study and discover not only the relations of symptoms and morbid conditions, but the relations as to priority and sequence, for thus alone can we construct a true pathology, and thus alone establish an intelligent system of preventive treatment. If we can know the sequence of symptoms and conditions, we can anticipate and avert, arrest or modify the ultimate result of pathologic processes. If we can, by large clinical observation, determine what disordered states of the system are most likely to act on the brain, we gain an important point. It is for us to inquire, therefore,

1st. Whether there are specific changes in the brain in insanity, and if so, whether there are any means of ascertaining positively or proximately what those changes are?

2d. Are there physical signs and symptoms indicating the presence and progress of such changes, which may be detected and relied upon, and what these are ?

3d. Are there *post mortem* appearances in the brains of those who die insane, which would justify the assumption that morbid cerebral changes were the potential and only ultimate causation of insanity ?

4th. Are there any sound reasons for an assumption that the mind can overthrow itself, independent of cerebral changes ?

5th. Do the secretions of the skin, kidneys, &c., throw any light upon the morbid condition of the brain in insanity, either regarding its pathologic state, its nutrition, or action ?

The important questions in each case are: What are the lesions ? What is the physical diagnosis ? The gravity of the case is by no means measured by the intensity of the mental manifestations. It constantly happens that, associated with trifling changes, there is great mental disturbance, and but little with more serious lesions. What are denominated mental symptoms have a subordinate place in diagnosis as well as in treatment. The mental manifestations, indeed, have the same relation to diagnosis and treatment that mental phenomena hold in delirium tremens, fevers, and diseases of children. They are symptoms, but only significant of conditions of the nervous system, which *conditions* are to be treated. In all the disorders of the brain, we mark carefully what symptoms or groups of symptoms given cases manifest ; and by this clinical observation, and by a knowledge of physiological laws, and by *post mortem* examinations we learn to interpret the morbid changes going on within the skull. There are no reasons why insanity should prove an exception to this rule. Until within a few years, diseases of the spinal cord were obscure, and the differential diagnosis anything but certain. But the recent investigations of Bernard, Brown-Sequard, Kussmaul, Van der Kolk, Romberg, Radcliff, Virchow, Bouchard and other neurapathologists have solved many of the greatest difficulties, and promise the most thorough elucidation of all. Among the most important practical considerations, overlooked in insanity, is the fact that organic changes in the brain are likely to occur very soon after the first morbid functional action is set up. To the lack of recognition of this fact must be attributed the vast multitude of chronic cases. Any bodily condition which disturbs the mind is too important to be overlooked or ignored. Prolonged wakefulness,—though it may not apparently disturb the mind,—indicates a condition of the brain which is not natural, and which should be inquired into. When this is associated with depression, groundless apprehensions, suspicions, and uneasiness, the case is one of grave import, and should command medical attention. Such a condition is significant of physical disturbance, and foreshadows insanity.

admissions for twenty-eight years.

1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.
33	26	21	19	12				
197	208	242	261	263	321	296	378	432
57	53	56	76	113	80	86	85	49
11.50	9.06	6.58	5.41	3.09				8
68.64	72.48	75.86	73.35	67.78	80.05	77.49	81.65	8~~4~~.66
19.86	18.46	17.55	21.24	29.12	19.95	22.51	18.35	11.34

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INSANITY, AND ITS RELATIONS TO MEDICINE.

GENTLEMEN OF THE SOCIETY, LADIES AND GENTLEMEN:

It will be generally admitted, that in the science of medicine, as in other sciences, no one of its various branches can be successfully cultivated without paying due regard to the connection between that branch and the whole body of knowledge to which it belongs.

The object of this address is to show the application of this truth to the case of psychological medicine, in which such application has hitherto been too imperfectly perceived and acted upon; to show that the treatment and care of the insane should be recognized as constituting a department inseparable from general medical science; its study and development governed by the same rules, and its progress made dependent upon the same causes, that advance or retard the progress of all medical knowledge. If this be true, it will appear, not only that a thorough acquaintance with this subject must be founded upon a comprehensive knowledge of the general science, but that, without such acquaintance, the study of the general science itself becomes defective, and that it should therefore form a part of the general course in all medical training, and be accorded a place in the schools where elementary principles are taught.

It was for a long time supposed that the treatment of the so-called diseases of the mind was quite a different thing from the treatment of diseases of the body; and this idea has not yet wholly disappeared. It will be my first object, in order to establish the connection between psychological and general medicine, briefly to touch upon some of the facts which tend to prove this supposition an erroneous one, and insanity to be subject to the same laws, and to present the same general pathological conditions, which are found in other diseases.

And first, a reference to the history of this branch of medical knowledge, will show that progress in it has been either rapid or retarded, in direct proportion as the method of studying it has been similar to that pursued in regard to disorders deemed purely physical, or has been founded upon the notion that it was a department of metaphysics rather than of medicine, and so made a subject of metaphysical speculation, instead of a subject of observation and experiment. There is evidence in the writings of the ancients, both of their philosophers and their medical men, to show that they entertained many clear ideas in relation to the physical causation of insanity; and as a consequence, it is safe to aver that, in recognition of the psychical phenomena of the disease, and in the moral treatment to be applied, we have at this day made no astonishing advance from the age of Pythagoras. The Fathers of Medicine did not regard insanity as a special department, but it was studied, investigated, and treated by them in the same way as other diseases. When Hippocrates was called to treat the King of Macedonia for disease of the lungs, his diagnosis revealed insanity, of which he cured his patient. His fame indeed rested partly on his skill in this direction; and owing to this, he was called to treat the philosopher Democritus, whom he found engaged in dissecting various animals, in order to discover the cause of his malady. "Hippocrates," says Burton, "relates (the story) at large, in his epistle to Damegitus, wherein he doth express, how coming to visit him one day, he found Democritus in his garden at Abdera, in the suburbs, under a shady bower, with a book on his knees, busy at his study, sometimes writing, sometimes walking. The subject of his book was Melancholy and Madness. About him lay the carcasses of several beasts newly by him cut up and anatomized; not that he did contemn God's creatures, as he told Hippocrates, but to find out the seat of this *atra-bilis*, or melancholy; whence it proceeds, and how it is engendered in men's bodies, to the intent that he might better cure it in himself, and by his writings and observations teach others how to prevent and avoid it, which good intent of his, Hippocrates highly commended." Medicine and philosophy were then dissevered. Hippocrates was a physician, and Demócritus a philosopher.

Among the Egyptians, we are informed, there were retreats for the insane, where wine, music, cheerful amusements and repose were the gentle and effective agencies brought to bear upon the disordered intellect, and modern skill has discovered no better aids to a successful treatment of the disease.

During the middle ages, however, the knowledge of the causes and treatment of insanity was almost lost. It was a subject peculiarly exposed to perversion, from the general tendency of the intellectual activity of those times to abstruse and barren philosophical speculations upon everything connected with the mind, and its relations to the body. Owing to this, as well as to other causes, psychology was the last branch of medical science to emerge from darkness after the revival of learning, and it has remained more or less clogged with the fetters of metaphysical theories even to the present day.

It would indeed be interesting to inquire into the various theories of insanity; but it is not practically important or profitable to do so in an address intended only to direct inquiry, awaken interest, and suggest practical hints. Still it may be proper to say in support of what I have stated, that strange as it may now appear, the almost universal belief, until a comparatively recent period, has been, that the mind itself was diseased —notwithstanding that such a dogma would imply its death, as what may be sick may also die. It is however due to medical science to say, that this has never been fully accepted by the majority of the leading minds of the profession. To show how this idea of disease of the soul or mind adhered to the science long after it was condemned by the developments and progress of pathological investigations, it is only necessary to refer to recent authorities. Dr. Bucknill, in a prize essay on Criminal Lunacy, in 1854, says that there are three theories, the psychic, somatic, and psycho-somatic.

With the impulse given to the study of mental philosophy by the writers of the eighteenth century, both in England and on the continent, no corresponding advance took place in the study of mental disorders.

The first step towards progress and improvement in this field of investigation, was not due therefore to mental philosophers, but to physicians and philanthropists. The labors of Pinel, and the results accomplished by him in ameliorating the condition of the insane, are known to all. It is not so generally known, however, that before the philanthropic efforts of Pinel were commenced, the subject had already received the attention of Benjamin Franklin, and other benevolent persons in this country. As early as 1750—forty-three years before the movement of Pinel—the Pennsylvania Hospital, at Philadelphia, was organized, and a department for the care and treatment of the insane established; in which the system afterwards advocated by Pinel, in France, was anticipated, and the barbarous method of treatment to which the insane were then exposed, was abandoned. In the preamble to an act of the Provincial Assembly, there are these noble words: "Whereas, there are frequently, in many parts of this province, poor distempered persons, who languish long in pain and misery, under various disorders of body and mind—and being scattered abroad in different and very distant habitations, cannot have the benefit of regular advice, attendance, lodging, diet and medicine, but at a great expense; and, therefore, often suffer for want thereof; which inconveniency might be happily removed by collecting the patients into one common Provincial Hospital, properly disposed and appointed, where they may be comfortably subsisted, and their health taken care of at a small charge, and by the blessing of God on the endeavors of skilful physicians and surgeons, their diseases may be cured and removed." Pursuing this preamble, an act was then passed founding a "hospital for the reception and relief of lunatics, and other distempered and sick poor," and providing for their reception, "without partiality or preference."

This system of moral treatment, the substitution of kindness for the lash, and of soothing influences, and comparative freedom from restraint, for confinement in narrow cells in filth and starvation, was the first great step towards a proper understanding of the method of curing insanity, although the theory of mental disorders was still imperfectly recognized. But the good effects of the improved methods were owing to the better hygienic and sanitary condition of the patients, and, if the full bearings of this fact as showing the intimate connection between general pathology and disorders of the mind were not recognized, observing men could scarcely fail in spite of false theories, from seeing the favorable results, upon the patients, of due attention to the physical aspects of this disease. It is also a fact which should be borne in mind in criticising the past, that without a rational theory, there could be no rational treatment; and that therapeutics could not have a principal place in the treatment, while the disease was unrecognized as a bodily affection, but considered as a spiritual disorder.

It will be remembered that at the period of which we speak, the latter half of the eighteenth century, the science of medicine was making rapid progress, and this period of its history is adorned by some of the most distinguished names both in this country and in Europe.

It may well be a matter of national congratulation that in this great reform America took the lead. All the known resources of benevolence and medical skill for the recovery of the unfortunate victims of insanity, were applied long before Pinel unchained the madmen in the Bicêtre. That great man accomplished vast results in France; but the records of sickening barbarities to which the insane were subjected in the hospital which was the scene of Pinel's reforms, in the heart of Paris, under the shadow of her schools of philosophy, and in the intellectual centre of Europe, is a striking illustration of the terrible distance to which psychological medicine was there left behind in the wake of the general advance of medical science. Simultaneously with the reforms of Pinel, the Retreat, at York, England, was proposed by William Tuke, under the auspices of the Society of Friends. The reports issued from this hospital were the first of the kind published, and did much to show the curability of insanity under proper treatment, while they awakened an interest in the subject which finally attracted the attention of civil governments to the necessity of the sanative care of this unfortunate class of persons, and thus inaugurated the system of hospitals which now prevails so extensively over this country and in Europe. With the establishment of this system, the care of the insane was transferred solely to medical men; the patient was no longer under the charge of a keeper, but under the superintendence of a physician; and as a result, insanity soon came to be regarded as a curable disease, and the reports of modern hospitals slowly but steadily spread this important truth, which it is so difficult, yet so essential, to impress on the public mind. These reports have further presented facts and statistics, and the collected results of observations, tending to dissipate the old error of the psychic theory that the soul or mind can be diseased; and, in consequence, this branch of medicine is now nearly released from the trammels of metaphysical vagaries. Moral insanity is the last remnant of the metaphysical school. This dogma once out of the way, and insanity is fully in the region of practical investigation, and within the domain of medical science.

The historical facts thus briefly noted show the result they were cited to prove. First, that progress in the proper understanding and more accurate knowledge of insanity, has not been owing to the advance of mental philosophy; but that, on the other hand, just so far as the methods and theories of mental philosophy have been applied to insanity, and the methods and theories of medical science have been neglected, just in the same ratio has progress in the knowledge and treatment of insanity been retarded. Secondly, the history of the investigation and study of mental diseases will, in support of the view that insanity is properly a branch of general medicine, disclose the fact that psychological medicine, whenever it has been free from the adverse metaphysical influences to which reference has been made, has kept pace with general medical science. The origin of the humane system of treatment for the insane, nay, the very existence of hospitals themselves, has often been attributed to the sole influence of religion. But making all allowance for the charitable impulses of religion, science alone can show how those impulses are to be carried out. Asylums have a history dating back three centuries; but what, we may ask, was their actual condition until a comparatively recent period, when medical science stepped in to enlighten religion itself, and to show what humanity really requires? Indeed we may say that to this day, in most cases in which this class of the afflicted have been left only to the chances of philanthropy and religious sympathy, and without reference to the system of hospital treatment provided by true science, their condition is actually little better than that of the same class was a thousand years ago. In the State of New York, and in other places, insane men and women are in chains and neglect, and this within the sound of church bells; and languish unvisited and unthought of by worshipping congregations, which annually raise thousands of dollars to transmit to remote nations to rescue and educate the heathen. It is hardly too much to say that this state of things will continue until medical men demonstrate the mode of relief, and declare its measure. Show civilized and religious communities *how* they shall arrest all this wrong and remedy it, and it will soon be accomplished.

That progress in the knowledge of insanity has come from advance in medical science, will appear more clearly from the following facts among others:

First. A large number of those whose names are distinguished in the history of medicine, have embraced insanity in the scope of their investigations, and made it part of their study and practice.

Second. If the condition of cerebral pathology at any given period be examined and compared with the pathology and therapeutic treatment of insanity at the same time, the pathological knowledge and the treatment will be found to correspond in character.

Third. Although the moral treatment of the insane has borne some relation to the general state of society, it has never been properly understood or effectively practiced except under the direction of physicians.

The same cruelties, as we have intimated, are practiced to-day, and tolerated by society, that were in vogue some centuries ago; and will so continue until medical science shall fully embrace the whole compass of the treatment and care of the insane, and make it a part of the duty of all physicians to meet, in study and practice, all requirements of this disease as well as those of any other.

It is a striking fact that the medical profession has in all ages persistently advocated the amelioration of the condition of the insane; that it has always stood in the foreground, and in every respect in advance of philosophers and theologians. Both the latter have at times stigmatized the disease as degrading; the one holding that mental endowments and culture alone were noble—had no sympathy for suffering—while the other, beholding in the moral perversions of the disease the operations of sin, and even possession of the devil, treated the wretched beings as though they were the authors of their own misery, and justly cursed of God. But medicine throughout this conflict stood by the sufferer even at the risk of being called unbelieving. In modern times, under the full light of science, we have almost the same spectacle practically, though not theoretically. To-day, almost without exception, the advocates of the cause of the insane are medical men.

Ministers, statesmen and scholars are silent; and the reason is, they feel and accept the fact that they are powerless to direct or carry out measures of relief, and look to the medical profession. What can be demonstrated as wise and practical by the medical profession will ultimately prevail. Let that profession solve the problem. Let it once assure the public of its capability and willingness to do so, by universal preparation to meet the necessities of treatment, and all difficulties will vanish, and the public mind will soon be divested of that dread which superstition and ignorance have thrown around the sufferers from this malady.

The third consideration advanced to show the connection between general medicine and insanity, is the fact already adverted to, that insanity is now generally recognized as a bodily disease, a disorder of the brain, and must take its place in the category of the neuroses, and is in fact the highest expression of this class.

But while it may be said to have a very wide range of causation, the pathological conditions are circumscribed. Says Dr. Bucknill, "It may perhaps be strictly said, that all the forms of mental disease are dependent on one of three states of the nervous system—a state of increased, or a state of diminished, or a state of unequal excitement of that system. There is almost always accompanying disorder of some of the bodily functions; of the circulation, which is so implicated with the nervous system, and of digestion and assimilation; and of the function by which animal heat is preserved and regulated." Has not the general profession in the study and treatment of disease, accomplished a great part of the study and treatment of insanity? The reciprocal influence of body and mind is a fact constantly before the physician. The fact that organic functions influence the mental state is well recognized. We all know that disordered conditions affect the mind in its emotional manifestations and intellectual activity. Certain morbid states in the lungs produces delusive hopes and gayety, which are in contrast with the actual state of the organ. Disease of the heart often produces depression, without any consciousness on the part of the patient of its cause. Certain conditions of the digestive apparatus exert an immediate influence on the mental state. It is in this way that the physician is constantly studying these conditions, and treating his patients in the recognition of the great law which underlies the study of insanity: that bodily conditions are the essential, potential causes of the mental state called insanity. Through the emotions we have all those ephemeral disturbances denominated passions, and with the subsidence of the cause, reason reasserts itself. In insanity we have the same thing, emotional disturbance and loss of calmness or reason. But here there cannot be as ready a subsidence of the cause as before; the cause being actual physical lesion, which must first be relieved. When a sane man chooses to control and direct his mind, and govern the fancies and incoherent train of thoughts passing through it, he does so by checking his emotions. The insane man is unable to do this, as his emotions are under the influence of a disordered physical state. His normal authority over himself, so to speak, is lost. The cerebral disease keeps up a constant irritation which is independent of the will, and in fact unknown to the sufferer, and unrecognized by him, and by which he is constantly misinformed. If it be true that the power of self-control or self-direction is the criterion of intellectual ability, and is the highest expression of normal mental action, then its loss as the result of disease, is the psychical test of a true alienation.

The departure from a normal state in the way of feeling, thinking and acting, may be recognized by the patient, and may be accounted for by himself, through physical lesions. No false judgment is formed; therefore there is no delusion, and the man is sane. He may hear false sounds, see images, feel depressed or excited, take a gloomy or unusually cheerful view of things, and recognize all as the offspring of a disordered state. One step more and he is insane. "The lesion of intelligence and the loss of consciousness of that lesion," says Baillarger, "are two very distinct facts, and both are necessary to constitute a true mental alienation."

If the foregoing views are correct, we cannot well avoid the conclusion that there is nothing about insanity to banish it from the field of general medical investigation; and at the present time when the profession is earnestly discussing the question of more thorough and systematic medical education, would it not be well to extend it so as to embrace the whole field of medicine? What is there more difficult in the medical investigation of insanity, than in epilepsy, and the various forms of paralysis? If these and other nervous diseases receive attention in the office of the preceptor, and in the lecture room, why should the most grave, and yet curable of all diseases of the brain be excluded, and assigned to the study of a few medical men? There are really no more obstacles to successful study here, than in the other diseases mentioned; and if there were, it could be no reason for the neglect, but, on the contrary, an additional reason why it should be studied. It is not characteristic of medicine to shun difficulties. Again, all the insane before transfer to hospitals must come under the observation of the ordinary practitioner, and he must sign a certificate of the existence of the disease. Should he not then be able to recognize it and understand its treatment? Because the majority of the insane are, and probably always must be cared for in hospitals, it is no reason why the minority who remain outside should not be treated, or if treated, treated ignorantly. If even only a small proportion can be managed successfully at their homes, it is the duty of every physician to prepare for their proper treatment. Further, if the early symptoms were better understood by physicians generally, how many cases would be checked, or modified in their early stages, and how much human suffering thus prevented? The knowledge of the premonitory symptoms of paralysis is surely more available for good, than the knowledge of the symptoms and treatment after the disease has fully manifested itself. And we have acquired this knowledge not by observing paralysis, but by patient investigation of preceding symptoms. So it is equally true of insanity. If the early symptoms of *melancholia* were as well understood by general practitioners as the premonitory symptoms of phthisis, how many suicides would be prevented, and how many advancing to that sad form of cerebral disease might be restored before its full invasion!

It has happened when I have advised persons to apply to their family physician, stating that their case is only one of general loss of tone and may be successfully managed out of an asylum, that the persons have returned with the answer that the physician was unwilling to undertake the case.

To attempt to set forth the study and treatment of insanity, would be an endeavor to embrace the entire routine of medical practice. Causation alone, indeed, embraces the most careful study of general medicine, as the disorder of any one organ may directly or indirectly affect the brain, and induce the mental disturbance. And the therapeutical treatment is but the application of well recognized principles. If insanity is caused by the vital depression following overwork, this state must be corrected. If it originates in the defective nutrition often associated with tuberculosis, then the remedies for tuberculosis are mainly to be relied upon. If in consequence of the functional impairment called dyspepsia, then that condition must be met. It is to medicine proper, therefore, that we are to look for relief, and the moral appliances of isolation, amusements, &c., must receive only secondary attention. Without the former the latter would effect but little. It is however important to study the psychical symptoms to be able to distinguish insanity from other forms of cerebral or nervous disorders. In a medico-legal view it is also important. But, I repeat, treatment is mainly concerned with the diagnosis of the physical lesions. There are cases where a knowledge of the delusions may lead to the diagnosis of the true pathological state. I recall the case of a man who insisted that he was not sick, yet complained that he had been frequently stabbed in the back by unseen assassins, and examination revealed spinal tenderness and disease of the kidneys. Do we not then come down after all to the simple practice of medicine, and the ordinary methods of study? There is no specific or peculiar lesion of the brain or nervous system, and no structural form which may be said to be the ultimate cause of insanity. Here we look for facts as in other diseases, and take into consideration cerebral or other lesions, and weigh their influences in inducing those ultimate conditions of exhaustion which are capable of producing the disease. The physiology of the brain is undoubtedly less understood than that of any other organ, and the study of its pathology must always be difficult.

A distinguished writer (Bucknill) says: "The physiological principle upon which we have to build a system of cerebral pathology is, that mental health is dependent upon the due nutrition, stimulation, and repose of the brain; that is, upon the conditions of exhaustion and reparation of its nerve substance being maintained in a healthy and regular state, and that mental disease results from the interruption or disturbance of these conditions." Here we have but the enunciation of the physiological principle underlying all pathology. Here we require rest, nutrition, sleep. Another writer (Griesinger) says: "There are, as in other affections of the brain, only three distinct categories of morbid elements, viz.:—lesions of sensibility, lesions of motion, and lesions of intelligence;" and "three great classes of elementary symptoms—disorders of the intellect, disorders of sensibility, and disorders of motion." This brings the study within narrow and well-defined limits, and at the same time is fully comprehensive of the whole field of psychological or psychopathic study. The mental or psychic symptoms may also be brought within an equally narrow compass. The departure from the normal standard in each individual case, consists in either increased or decreased cerebral activity. The morbid mental manifestations are excitement, depression, enfeeblement, or as well expressed by Professor Griesinger, "psychical depression, psychical exaltation, and psychical debility."

It only requires systemization to commence the successful teaching of this branch of medicine. Materials are already within reach, and the field of pathology is not unknown.

But it may be asked what resources would a general pathologist have who attempted to embrace insanity in his course of instruction in connection with the neuroses?

1st—He would have a vast literature.

2d—He would have a large field in the carefully-observed hospital records.

3d—The opportunity of observation in hospitals.

4th—An actual *clinique*, which would soon surround experience, presenting most of the milder phases of the disease, and certain chronic conditions, as mania of long standing, dementia and paresis.

5th—Cases in consultation, which would soon familiarize him with all the difficult and obscure manifestations.

As to the literature, I need hardly say that it is more voluminous than that touching any other nervous disorder.

Of the resources contained in hospitals, it would be difficult to estimate the value. These contain volumes in description, diagnosis, pathology and therapeutics, which yet remain to be utilized. The thousands of cases described would embrace every form of disease—all the symptoms, somatic and psychic of the preliminary stages—the development—the progress—the treatment—the relation of condition to the various restorative means used—the morbid conditions—functional and organic, causing insanity, or associated with it in the several forms and stages of this malady—diseases and conditions intercurrent—states of physical health and mental irregularity resembling or approaching, yet not crossing the border of insanity. These records, made from time to time, through the course of many years by various persons, are actual cases, and studied carefully, would be admirable substitutes for that clinical presentation which would, at least for the present, be impracticable. As the cases are written out by frequent entries, they are also uncolored by theories of the observer.

Here could be brought out every type or shade of mania, melancholia and dementia. Groups produced, embracing all that would be necessary to instruct the student, to enable him to understand and appreciate the disease, and put him fairly in the way of practical observation, teaching him what to look for, and how to recognize the symptoms which show especially the influence of morbid physical states over the operations of the mind through cerebral conditions.

A professor well-read in the literature of insanity, and familiar with nervous diseases and nerve pathology, would soon acquire the practical information requisite for successful instruction by entering a public asylum for a time. And this opportunity would be cheerfully extended by those having such institutions in charge, and the public would welcome such an omen for the general good. The extension of medical study and teaching to embrace thus the whole field of medicine, would awaken interest, and bring out those men of education and culture peculiarly adapted to special study. That great teacher of pathology, Griesinger, of Berlin, enriched his vast fund of pathological learning, and acquired the added power of utilizing it as a teacher, by seeking observation and experience in an asylum for the insane. His work on mental diseases, which has recently been translated and published by the New Sydenham Society, is second to no work on the subject in interest and practical instruction to medical men; and to the alienist it is doubly interesting, as it brings him so fully into the broad domain of general medicine, and reveals to him what he constantly feels, more and more, as experience widens, that he is inseparably associated with general medicine, and cannot move a step without its aid. And here let me remark, that no physician can be long in practice in a hospital for the treatment of insanity, without experiencing the absolute necessity of re-reading medicine, and especially all that pertains to nervous diseases and nerve pathology. He soon discovers that almost every case must be examined and treated through his general professional knowledge, and he becomes more and more indifferent to the mental symptoms as expressed in delusions and delusive ideas, giving his attention mainly to abnormal sensations, and the origin and progress of morbid processes in special organs, or the system generally. Moral causes fade away under practical observation, and what would seem to be excitement, or depression, or enfeeblement of mind, are, under experience, referred to tuberculosis, anemia, or other special or general conditions of impaired physical health. How these mental conditions may originate in and be sustained by the neuropathic irritation aroused under the depressed vitality of tuberculization, or other morbid processes, we may not know precisely, but we do know that these states disappear if the physical lesions are removed.

I am well aware that this subject of extending the course of medical training to embrace the study of insanity, is beset with difficulties; but they are not insurmountable. Spasmodic efforts to accomplish this result have been made in this country, and in Europe, from time to time, but until recently these have not resulted in any great good, at least not in establishing psychopathy as a recognized part of study. Dr. Benjamin Rush probably gave the first lectures on the subject. In 1791, he was called to the chair of the Institutes of Medicine and Clinical Practice in the University of Pennsylvania, and was one of the hospital physicians. He delivered lectures to the students of the University, on insanity, with clinical instruction as a part of his course. This was continued till 1812, when his lectures were published—" an elaborate work which had long been impatiently expected." (*Encyclopedia Brittanica.*) In committing them to the public, he says, "it is with the hope that they may serve as a supplement to materials already collected, from which a system of principles may be formed that shall lead to general success in the treatment of diseases of the mind;" expressing the conviction that they could "be brought under the dominion of medicine, only by just theories of their seats and proximate causes." He undoubtedly disseminated the then prevailing opinions of the nature, pathology and treatment of insanity, and made an impression which has not yet wholly disappeared. His work became a standard and recognized authority. Among his labors was the translation of Sydenham, and a refutation of his theories of insanity, and the substitution of his own, which were in harmony with the prevailing views of pathology and therapeutics of his time.

Esquirol, in France, delivered lectures to his pupils in 1810, but he was not associated as a teacher with any of the schools of medicine. His writings, however, were appreciated, and his influence on psychological medicine was justly great and enduring. Sir Alexander Morrison delivered lectures in Edinburgh and London for many years, says his son, "to the members of the medical profession, and to such other gentlemen as signified their wish to attend them;" and "was encouraged to do so by His Royal Highness the late Duke of York, when he had the custody of his father, George III.

Dr. A. I. Southerland, at St. Luke's Hospital, London, delivered lectures on the pathology and treatment of insanity, from 1843 to 1855. More recently (1853) Dr. George Johnson delivered lectures on the subject before the Royal College of Physicians, in Edinburgh. Dr. Daniel H. Tuke has for several years delivered lectures on psychological medicine at the York School of Medicine. Dr. Guislain began in 1849 to deliver clinical lectures on insanity in the Insane Asylum of Ghent, before the students of the University in that city; Baillarger and Ferrus also in Paris as early as 1854; Dr. Pliny Earle in this country before the Berkshire Medical School, Massachusetts; and Dr. Tyler to a few pupils at Cambridge, Massachusetts. But all these, and other efforts at instruction which might be mentioned, have fallen short of systematic or efficient results, because they were partial in scope, and maintained that isolation which failed to awaken sympathy, or touch that chord of association which binds and allies any one part of medicine with the whole.

It was reserved for Professor Griesinger, in Zurich, Switzerland, and now of Berlin, to bring to those great schools of medical learning, the full realization of the importance of this subject to general medicine, as well as psychology, and to secure full instruction in this branch in connection with the teachings from the chair of pathology. Thus has been established "its true position as a proper and profitable subject of study, and as one demanding alike systematic and clinical instruction," and "its recognition as a regular portion of medical education." This distinguished pathologist maintains with his characteristic comprehension of the whole field of medical research, that medicine is one study, and that the interdependence of all its branches forbids the successful study of any dissevered from the whole, and that "the lesions of the brain and nervous system constitute the real subjects of treatment, and their discovery is the true province of diagnosis." "Thus," he declares, "is psychiatrie intimately allied with the whole subject of cerebral and nerve pathology. What psychiatrie is, is understood by him alone who comprehends this alliance; and he only who has been duly instructed in the difficult questions of diagnosis in cerebral and nerve diseases, can embark on these problems respecting mental disorder, with hope of satisfactory results." Professor Griesinger in a recent letter says: "I remain firmly in the opinion that it is an absolute necessity to provide in every medical school for a clinical instruction in this branch of science, equally important for the welfare of the patients and their families as for the forensic duties of the profession. I remain also in the opinion that mental diseases are only a part of cerebral and nervous diseases, and that it is most convenient to connect intimately the study of mental science with the study of the pathology of nervous diseases.

"Clinical teaching in psychiatrie is not merely a future possibility, but an existing fact in several medical schools in Germany: the difficulties are by no means so great as many people think; nay, the carrying on work of this teaching is very easy, if only men of good will and experience are charged with the execution.

"Since my first lecture of 1863, I was constantly occupied in this line. At Zurich, in the summer courses of 1863 and 1864, I had a very satisfying psychiatrical clinique, only in an old and small asylum, but with really great advantage for the pupils. Since the nearly three years I am at Berlin, my psychiatrical clinique had an augmenting success every year, and my results have been very satisfactory. The Prussian Government accorded me at my proposition, when I entered its service, the invaluable institution of a special division of the insane patients. So I can unite *de facto* the study of the two intimately connected branches, and I give now in the winter course regular lectures on nervous diseases with clinical demonstrations in each lesson. I think this way the best for the professor and for the pupils, and, I may say, for the advancement of science; but if however such a combination of the two cliniques may be impossible at another place, then I cannot but strongly recommend to carry out the clinical teaching of psychiatrie alone."

Within a year, the Bellevue Hospital Medical College of New York, has established a chair of "Diseases of the Mind and Nervous System," to which Dr. William A. Hammond has been appointed, and the "College of Physicians and Surgeons of New York" has appointed Dr. D. Tilden Brown, of Bloomingdale Asylum, lecturer on Psychological Medicine and Medical Jurisprudence. Thus the initiatory step has been taken in this country.

The intimate mutual connection of physiological laws in the maintainance of the economy, is a type of the complex symmetry of nature, and should teach us, as we seek to interpret her, that pathological laws are equally symmetric and interdependent.

It is eminently true of all the neuroses, that they are not only intimately allied to each other, but to the great mass of diseases not classed as nervous, and after interchange by what we choose to call metastasis; and thus what is one moment a gout of the toe, is the next a frightful gastralgia. To this rule insanity not only affords no exception, but is of itself the highest illustration. Cases could be given where the psychological manifestations never for a moment entered into their therapeutical aspects. Cases for example of acute mania, and melancholia, where tuberculosis of the lung was the pathological lesion; and cod liver oil, stimulants, and generous diet were the therapeutical agents necessary for securing recovery.

I would not, however, wish to be understood as ignoring the value of psychological manifestations, while urging the greater importance of somatic symptoms. It is nevertheless true that the diagnosis of insanity in the various forms of mania, melancholia and dementia—paresis, epilepsy, &c., is but an insignificant part of the study, and may readily be acquired; but to diagnose the nature and seat of the physical lesion of the brain and nerves is the great problem to be solved in each individual case, and here the alienist stands side by side with the general practitioner. The diagnosis and treatment may be difficult; but the study, comprehension and application of the general principles of pathology and therapeutics are not essentially different from those which any intelligent practitioner is constantly called upon to apply. There is nothing mysterious or peculiar in the methods of study or treatment. It is the patient and careful investigation of laws, and the application of well recognized principles in medical science; and not a question of interpretation of mental phenomena, or the study of mind, so much as an observation of the reciprocal influence of morbid physical and psychical states on the great nervous center, the brain. It is true there are disorders of sensation which may sometimes disguise or obscure the symptoms, and thus lead the physician away from the real lesion. There are cases of latent phthisis where sensation is blunted; the cough and expectoration are suppressed because of the condition of the nerves of sensation in the lungs. Here the true cause of cerebral trouble may not at once be detected—may indeed seem to be something else than tubercular degeneracy. But experience would soon teach the practitioner the importance of exploring fully the whole organism in every case before settling on a doubtful diagnosis, and physical exploration would reveal the operating cause and source of the morbid mental manifestations.

We all know and feel the importance of that hygiene, for body and mind, which, in the language of a distinguished writer, is "prior to diseases, to their diagnosis, their history, and their treatment;" "prior to them and beyond them; things earlier than their beginning, which deserve to be known—the habits, the necessities, the misfortunes, the vices of men in society." But we also know and feel that these are beyond our control: we only advise. We all realize the vital importance of meeting disease at its earliest inceptive stages, in its premonitions. And as insanity has its origin mainly in minor nervous affections, and in the conditions and diseases under the observation of and familiar to the general practitioner, if he were instructed in its preliminary and developing symptoms, how often might not the disease be averted or arrested, and in how many more cases so controlled in the beginning as to be treated at home, and, in others, hospital treatment advised before any unfavorable advance of prostration. Still, the question may properly be asked, after all, will not the insane be always treated in hospitals, and more successfully? and where is the particular advantage of doing more than simple diagnosis in a general way may require? We think this has been answered, and indeed if but one case in a hundred can be treated successfully at home, it would be the duty of the profession to be prepared to treat that with all the appliances and skill which advancing science may command. No one would be justified at this day in an experimental routine which might prove more disastrous than the disease if left to itself. But the fact is, one in twenty, and perhaps more, might be successfully treated out of hospitals, if the profession were as familiar with the disease as they might be.

It seems to me, that every possible consideration urges to the complete union of the profession, and against any further tendency to specialize in study or treatment, in a strict sense of the term. There always have been, and probably always will be, professional men who, after the thorough study and survey of the whole field of medical science, choose to devote themselves to the practice of some one branch—but they are not necessarily specialists. In fact can we admit specialties? These, so called, have their origin in necessity, and are temporary. In the progress of medical science from entire darkness, special fields were necessarily explored by laborers and observers. It required the whole lives of many men to explore the fundamental laws of physiology and pathology, and to observe and record the action of remedies, where from the nature of things there was so much obscurity. Special workers, thus engaged in limited fields, have undoubtedly contributed to the more speedy and thorough development of knowledge and practice. This division of labor has therefore served a wise and noble end, and has hurried many obscure things to early and clear demonstration. This system of investigation has also brought out those of peculiar aptitude to special fields, and has thus thoroughly utilized ability and knowledge, and strengthened the profession and blessed mankind.

But this practice or order of expediency should not be carried too far, as some would argue, because it would encourage empiricism and superficiality in study. We should adhere to unity. All are members of one body, with one aim and one glory. Psychological medicine especially, is too intimately allied with general medicine to admit of specialization in any true sense of the word. With the advance of medical science, insanity has been more and more practically understood; and, happily, the mystery and dread associated with it melt away under the light of investigation and experience; and both physicians and laymen see it in a less formidable light, when it is brought before them in its true character of a cerebral disease, and only a disease. Now the triumph is complete—mystery and superstition vanish, and the insane man stands forth simply as a sick man: one, who by reason of cerebral disease, is unable to use his brain—not a man with a mind diseased, a mad mind, an enfeebled mind—but with a brain and nervous system so disordered as to disturb, confuse, heighten, or lessen the mental operations; a mind acting through a disordered organ—a spiritual being untouched by disease, looking through the disordered and broken house in which he dwells.

We must hail the complete union of this apparently dissevered branch of medical inquiry and practice, with the whole field of professional inquiry. It is of the cerebral affections among the gravest, and yet most curable, and cannot be isolated. It should be studied, taught and practiced with its congeners. There is, we all admit, nothing in the disease beyond the study and scope of the practitioner. The literature is abundant, and unfortunately cases are too numerous to justify the plea of lack of opportunity for observation and treatment. Indeed, there are many members of the profession who treat certain cases of sub-acute mania and melancholia successfully in their families, and if there is not favorable progress made, or obscure symptoms arise, seek advice and consultation with those more familiar with the subject, as we all do in other diseases. Indeed it is not uncommon for a physician to accompany a patient threatened with insanity, or other serious nervous disorder, and consult in regard to the case and its treatment with those who are connected with hospitals, or those who have been.

If the profession who recognize the hospitals for the insane as such, and not as receptacles for confinement, would always accompany their patients whom it is necessary to treat therein, and go through the institution, and interest themselves in the methods of management and treatment, many popular errors would be dissipated, and the profession would soon become familiarized with the general subject, and be able and disposed to direct the pupils in their offices, in the necessary preliminary readings, and thus facilitate the introduction of this branch into general study and practice, as a required and recognized part of medicine.

In conclusion, brethren, let me congratulate you on the advance of our glorious profession. Year by year she treads more firmly and securely the paths which lead into the very arcana of our subtle nature; and whatever of this wondrous mechanism and these mysterious forces she fails to penetrate or measure with eye and hand, she explores and weighs with cunning instruments, the devising of her own ardent children.

More noble than philosophy, which extended no charity to the sick, infirm and defective, she accepts the divine command to care for the poor, the sick, the maimed, the blind, the deaf, the dumb. Step by step she has advanced and forced her way through oppositions of ignorance, of skepticism, of superstition, and crowned her votaries with immortal honors. Having caught a glimpse of the inner man, she has relaxed no efforts towards exploring every tissue, and her mission will only be fulfilled when she has comprehended every law of man's being, and exhausted the resources of nature in his behalf.

The sublime spectacle of Vesalius in his first dissection, illustrates the holy ardor, the nobility, the heroic courage of the profession in his age, and in all ages. In the path of investigation was toil, and dishonor, and death, but it was the road of life for all the race of man. On his vision shone the glorious light of coming triumph in medicine—the disinthrallment of that science which should save the race. He died a martyr to his zeal, but his work survived.

To-day medicine is the same. She still follows man in every step, from the hour of his conception to his death. If he fails through weakness—if he falls in the virtuous and legitimate struggles and duties of life, if overcome of appetite or passion, he sinks into disease or degradation—if in pestilence or war, on sea or land—she is alike at his side, a minister of healing.

Blessed, beautiful profession, symbolized, yea, practiced by Christ himself!

And ye who tread her princely courts, are justly proud,
And they who feel her gentle hand, are truly bless'd.

4

SECONDARY DEGENERATIONS

—OF THE—

SPINAL CORD,

—BY—

CH. BOUCHARD.

TRANSLATED FROM THE FRENCH BY

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SECONDARY DEGENERATIONS OF THE SPINAL CORD.

Comparatively recent observations in nervous diseases have proved that when a nerve fibre is injured in any part of its course, it undergoes certain degenerative changes in that portion which is cut off from its connection with the nervous centre, from which it derives its supply of nerve force. In other words the alteration commences at the seat of the lesion and proceeds in the direction of the transmission of nervous force. If, therefore, we have any disease interesting the brain or upper part of the spinal axis, by which certain fasciculi of nerve tubes are destroyed, we can trace these degenerated tubes throughout their course along the spinal cord, observing with accuracy whether they terminate in the gray matter of the cord or pass off in the anterior roots of the rachidian nerves. In the same manner lesions of the posterior roots, or lower segments of the cord result in such alterations of the posterior columns as to admit of our tracing the injured tubes in a centripetal direction.

It being well proved that the ultimate nerve fibres do not anastomose with one another, but continue their course distinct and separate from their peripheral to their central extremity, we have a reliable method of studying each individual nerve throughout its passage along the cord, as well as of investigating its relations to the central ganglia, by carefully observing the alterations which are secondary to primary lesions of the nerve tissue.

This power of following a nerve tube along its course is of inestimable value in investigating into the pathology and physiology of the nervous system; and accurate observations of cases will doubtless result in a great advance in our knowledge of this complex and difficult subject.

I have translated the following work of Bouchard upon secondary degenerations of the cord, in hope that it will lead those who have opportunities of meeting with such cases to keep careful records of the symptoms and post mortem appearances, which, when tabulated and compared with one another will doubtless serve to elucidate some of the difficult problems which are so continually presented to us by the nervous system.

ALBANY, Nov. 22d, 1868. E. R. HUN.

Besides the lesions proper of the spinal cord which result from a primitive alteration of its tissue, there are others which occupy, as a rule, the whole length of the rachidian axis, which develop very rapidly and almost at the same time throughout this whole extent, and follow either primitive lesions limited to one point of the cord itself, or lesions of the brain, or lastly alterations of the posterior roots.

These secondary degenerations of the cord take no part in the proceedings of the primary lesion. They have their own physiology and pathological anatomy, their special course, the same in every case, whatever be the nature of the diseases of which they are the consequence. They result from that property common to all nerve tubes which, injured at one point of their course, become altered throughout all that portion which has thus lost its relations to the parts from which they take their origin, and which exert a preponderant influence on their nutrition.

Thus interpreted, these alterations of the cord well deserve the name of *secondary degenerations*, and differ essentially from other affections also described as secondary, but which are only the radiations to the cord of a process developed in a neighboring part, such as myelitis or sclerosis consecutive to spinal meningitis; such also as those diffused scleroses of the cord so frequent in general paralysis,* and of which M. Magnan has demonstrated the relations with the cerebral lesions peculiar to that disease.

I should say, at the commencement, that these secondary degenerations of the cord very often escape even a careful examination. Notwithstanding when the attention is drawn to this point we not infrequently discover them with the naked eye. In all cases, certain anatomical processes which I shall explain hereafter, always enable us to recognize them easily. This research, I think, should not be any longer neglected, for the secondary degenerations have their own symptoms independent of those of the primary disease; they may persist after the disappearance of that disease, and then betray themselves by permanent functional disorders which, if one was not forewarned, might be attributed to another cause; lastly, they tend to elucidate certain points still very obscure in the physiology, and above all, in the normal anatomy of the spinal cord.

Was it not for the difficulty of proving them in the absence of the means which we employ at this day, one would have the right to feel astonished that the secondary degenerations of the spinal cord had not struck the observers who have studied the lesions of this nervous centre before the present time. Their discovery is in fact of recent date. In going over the ancient works on this subject, I have found but one fact which is connected with it: it is given in the Sepulcretum.* It is in reference to an atrophy of the left half of the cord in a case of a considerable lesion of the right hemisphere. But the author of this observation, to which I shall refer again, Wepfer, knew not how to interpret it. Not only he did not know that a hemiplegia of the left side can be due to a lesion of the right hemisphere, but still more, did not attribute any importance to the lesion of the cord because the arm alone was paralyzed.† Morgagui,‡ who has commented at length upon the observation of Wepfer from a point of view different from that which we now occupy, appears to have noticed the relation which exists between the lesion of the brain and that of the cord. He says, indeed, in the few lines which he devoted to this last alteration, that the lesions of the right hemisphere, "*diminuèrent aussi pendant longtemps l'afflux des esprits dans la partie gauche de la moelle épinière.*"‖

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* Etudes cliniques et anatomo-pathologiques sur la paralysie générale; prix de l'Académie de Médicine, 1865.

It is in fact to Mr. Cruveilhier that the honor of having discovered the descending secondary alterations consecutive to cerebral lesions, is due. He has followed them in the peduncles, in the pons and in the bulb, but he has not recognized them in the cord. I wish to cite this passage according to the text.§ "The attention of observers cannot be drawn too much to the appreciation of the influence of hemorrhage and other lesions of the brain on the condition of the cord, and reciprocally of the influence of lesions of the cord on the condition of the brain. I can give this as a positive fact that the lesions of the cord do not exert any influence upon the brain, but that the lesions of the brain have a very marked action on the cord, both with reference to its functions and its organization. Thus, often coincident with apoplectic cicatrices, a result of the almost complete destruction of the optic thalamus, I have found the anterior pyramid of the same side, and consequently of the side opposite to the hemiplegia, atrophied. This atrophy continued in the prolongation of the pyramid across the pons, and even in front of the pons in the inferior layer of the anterior peduncle. I have not followed this pyramid downward below the decussation. Finally, I have never found, even in the oldest hemiplegias, the corresponding half of the cord atrophied, or at least the difference between the right and left halves of the cord has not struck me, by which I do not mean to say that, a difference which escaped me may not become appreciable to the eyes of a more attentive observer, whose ideas are directed especially to this point."

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*Theophili Boneti Sepulcretum, lib. 1, sec. 15, obs. 4, p. 360: Lugduni, 1700.

†Ibid., Scholies de l'observation.

‡Recherches anatomiques sur le siège et les causes des maladies, traduct. de Desormeaux et Destouet, t. 11, lettre xi., No. 10, p. 116.

☞ ‖Thus diminished for a long time the afflux of the spirits into the left half of the spinal cord.

§Cruveilhier Anatomie pathologique, liv. xxxii., p. 15.

This observation has given to L. Türcke* the results which M. Cruveilhier had foreseen. In a first memoir, presented in 1851 to the Academy of Sciences of Vienna, he showed the alterations of the cord consecutive to different cerebral lesions, and also to certain partial destructions of the tissue of the cord itself; and he drew from these facts rigorous deductions concerning the structure and distribution of medullary fibres as well as some physiological consequences much more contestible. Two years later, in a new communication,* he analysed thirteen cases of secondary degeneration in consequence of cerebral lesions, and twelve others resulting from primitive alterations of the cord. Finally, in 1855, he incidentally came upon this question in another memoir.† Notwithstanding their importance, the works of Türcke have not attracted great attention. We find them very summarily mentioned in the treatise of Rokitansky;‡ they are not even spoken of in that of M. Lebert. At the same time that Türcke published in Germany the result of his researches, analogous discoveries were made in France and in Holland.‖ MM. Charcot and Turner§ presented to the society of biology an example of decussating atrophy of the cerebrum and cerebellum, and noted also a descending atrophy which followed the cerebral peduncle, the pons, the anterior pyramid of the atrophied cerebral hemisphere and the antero-lateral column of the cord on the opposite side. Some years later M. Turner¶ reproduced this fact in his thesis, reporting with it two analogous ones. Similar facts had already been given by Rokitansky.

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* Ueber secundäre Erkrankung einzelner Rückenmarksstränge und ihrer Fortsetzungen zum Gehirne, dans Compte rendu de la section de mathématiques et sciences naturelles de l'académie des sciences de Vienne, Mars, 1851.

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* L. Türcke, Compt. rend. de. l'Acad. des Sciences de Vienne, t. xi., p. 93, juin, 1853.

† L. Türcke, Beobachtungen über das Leitungsvermögen des menschlichen Rückenmarckes. Ibid., t. xvi., p. 329, Mai, 1855.

‡ Lehrbuch de Pathologischen Anatomie, t. 11, p. 485, 3e édit.

‖ Schroeder Van de Kolk, Waarneming van ene atrophie van het linker halfrond der hersenen met gelijktijdige atrophie du regterzijde van het ligehaam. Verh. der Eerstê kl. van het Nederl. Institunt, 1852; Derde Reeks., D. V., p. 31.

§ Exemple d'atrophie cérébrale avec atrophie et déformation dans une moitié du corps (Compt. rend. de la Société de biologie, 1852, p. 19).

¶ De l'atrophie partielle ou unilatérale du cervelet, de la moelle allongée et de la moelle épinière consécutive aux destructions, avec atropie d'un des hémisphères du cerveau. (Thèses de Paris, 1856.)

It would seem that these facts should have had a place in the discussion relative to the alterations which divided nerves may undergo. These two questions, so to speak, contemporary, and which could have thrown light upon one another, were nevertheless developed almost independently. At the same time that Türcke communicated the result of his first researches, at Vienna, Waller* published at Bonn, at London, and at Paris, his experiments on the degeneration of divided nerves. In point of fact his observations did not bear upon the elements of the nervous centres; but the laws of the degeneration of nerve fibres such as he has formulated them seem to me rigorously applicable to our subject. It was also at this time when MM. Philippeaux and Vulpian† made known their researches on the regeneration of nerves, that the study of the secondary degenerations of the nervous centres was undertaken in France. In the case published by M. Gubler,‡ an alteration of this nature commencing at the primary lesion of the brain descended across the peduncle to the pons. It was not followed further, and the condition of the cord is not noted; but already at this time an observation, cited by M. Gubler, had been presented to the society of biology by M. Charcot. In this case the descending lesion was not only manifest in the peduncle, the pons, and the anterior pyramid of the same side, but it continued in the antero-lateral column of the opposite side of the cord.

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* We cannot say that Waller discovered an alteration of the posterior columns of the cord as a result of the lesion of the posterior root. He has certainly observed that, when these roots are divided, they degenerate between the point of section and the cord, and even that the alteration advances for a short distance into the substance of the posterior columns; but what he saw here was only an alteration of the intermedullary portion of the roots. Augustus Waller, Nouvelle méthode anatomique pour l'investigation du systeme nerveux (lettre à l'academie des sciences du 23 Novembre, 1851:) Bonn, 1852.

† Sur la Régénération des nerf séparés des centres nerveux. (Memoires de la société de biologie, 1859, p. 343.)

‡ Du Ramollissement cérébral atrophique envisagé comme lesion consécutive à d'autres affections encéphaliques (Arch. gen. de med., t. 11, p. 31, Année, 1859.

Since this time, a large number of cases have been gathered at the Hospital of the Salpêtrière by M. Charcot and by M. Vulpian, and have been, during the course of the year 1862, the object of important communications made by those physicians to the Society of Biology. In 1863, M. Cornil* had occasion to observe with M. Charcot some similar facts. He says that in six cases of old hemiplegia from cerebral lesion, they could discover five times the descending alteration in the mass of the brain, in the peduncle in the pons, in the anterior pyramid. He adds that they find the same alteration in the cord, but he does not fix either the seat or the extent of this alteration. The same year Leyden† published a remarkable case of secondary degeneration of the cord consecutive to compression by Pott's disease, and M. Cornil communicated to the medical society of observation an analogous case found in the service of

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* A typographical error makes it appear that M. Cornil said that the secondary lesion occupied the anterior pyramid of the side opposite to that of the cerebral lesion. It is on the contrary always on the side of the diseased hemisphere that we find the pyramid altered.

Cornil. Note sur les lésions des nerfs et des muscles liées a la contracture tardive et permanente des membres dans les hémiplégies. (Société de Biologie, 1863.)

† Die graue degeneration der hinteren Rückinmarcksstraenge: Berlin, 1863.

M. le Dr. Charcot. In 1864, M. Laucereaux* compared the atrophy of the optic nerves in cerebral amaurosis to these descending degenerations of the cord, of which he gave some new observations. I had also at the same time an opportunity to meet frequently with these secondary lesions as a consequence of diseases of the brain or of primitive lesions of the cord, in the service of M. Charcot. I communicated several cases of them to the Anatomical Society and to the Society of Biology. Some of these observations have been published.† I gathered, in 1865, some new cases at the St. Eugênie Hospital in the service of M. Triboulet; and two cases to which I shall have to return, have been presented at the Society of Biologie, one by M. Cornil, the other by M. Charcot.

PATHOLOGICAL ANATOMY.

The secondary alterations of the spinal cord are never observed except in the fasciculi of the white substance. The gray substance has always been found intact. We could, indeed, foresee that this degeneration would only affect the conducting elements, and that it could not attack the elements which possess in a higher degree a peculiar activity, nutritive and functional, and which we rightly consider as nervous centres. These degenerations have been observed in the white substance of the anterior part of the cord and in that of the posterior part. When a white fibre is wounded by whatever cause, in one part of its course, either in the cord itself or in its encephalic prolongations, the secondary alteration supervenes as a rule, only on one side of the primitive lesion, either above, or below, but it extends throughout the whole length of this portion to its central or peripheral extremity. Hence, the names of ascending degeneration and descending degeneration. Only the injured fibres are altered, and they are altered in their whole extent from the point of the lesion. Now as the white fasciculi of the cord receive on their way new fibres which cannot participate in the degeneration, it results that the secondary alteration will undergo a relative diminution according as we go further from the point primitively affected. As, on the other hand, the fibres which exist at this point, and degenerate, have not all the same destination, but are lost from time to time in the gray substance, it also results that, in following the degeneration from its origin to its termination, we will find that it undergoes a diminution not only relative, but even absolute. Let us see now in what this degeneration consists, and by what characters we can recognize it.

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* De l'Amaurose liée à la dégénerescence des nerfs optiques dans les cas d'altération des hemisphéres cérébraux (Archives gen. de Méd., t. 1, p. 47: 1864.)

† Bouchard, Rapport sur une observation de compression de la moelle. (Bulletins de la société anatomiques, juillet, 1864.)

Aphasie sans lésion de la troisieme circonvolution frontale gauche. (Compte rendu de la société de biologie, 1864, p. 111.)

De l'Ataxie locomotrice progressive au point de vue de ses lésions anatomiques et de ses rapports avec diverses maladies peu connues de la moelle épinière. (Journal de Médecine de Lyon, Novembre, 1864.

Trousseau, Clinique Médicale de l'Hôtel Dieu de Paris, t. 11, p. 604: 1865, observation de Egris Valentine.

Here is the place to recall briefly the effects produced by the section of nerves. These experimental studies have given results which offer the greatest analogy with those which we are about to study. We know since the works of Waller* and of MM. Philippeaux and Vulpian† that the nerves, the connexions of which with the nervous centres are destroyed, present at the end of

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* Loc. cit.

† Loc. cit.

twenty-four hours, a diminution of their peculiar excitability. This enfeeblement extends from the centre to the periphery, gradually augments, and finally all activity entirely disappears by the end of the fourth day. At this period the elements of the nerves which had not yet offered any appreciable alteration of their structure, commence to present marked modifications which bear witness to a serious disturbance produced in their nutrition. After the fifth day the medullary substance of the tubes is, so to speak, coagulated, and at the same time fissures form in its thickness and divide it into unequal and irregular blocks; this is what we call the segmentation of the nerve tubes. Very soon afterwards, these fragments of medullary substance are seen to be studded with fatty granulations, which go on multiplying, and which take the place of the former throughout the whole length of the tube. At the end of a certain time these fatty granulations are reabsorbed, and we see only the neurilema withered and shrivelled upon itself. What becomes of the axis-cylinder while this retrograde work is going on? This is a point which has not yet been completely cleared up. Let us add that the tubes thus destroyed can become regenerated; but they do not reform *in situ* but are only the expansion, the budding forth of tubes which remain healthy above the point cut.* It is at the end of fifteen days, at the soonest, that we can find the first indications of excitability in the regenerated nerve; at first in the parts nearest to the section, then at points successively more and more distant.

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* This opinion, which appears generally admitted by physiologists, is not absolute. M. Vulpian has shown, indeed, that in certain animals, by choosing young subjects, we can obtain, without any influence of the centres regenerations of the hypoglossal and of the lingual nerve.

Similar researches would be applicable to secondary degenerations of the nervous centres; but experiments have not as yet, so far as I know, been employed in this special study. Besides, the pathological facts do not allow us to follow so easily the evolution of this morbid process. The cerebral or spinal disease kills the patient before the alteration of the involved tubes can become evident, or on the other hand death comes when the degeneration is complete, or when the fatty granulations have already been reabsorbed. I have nevertheless, twice made observations during the passage from the state of segmentation to the granular condition. I ought to mention here that, if we can come to conclusions from the analogy of what is known of the nerves to that which ought to take place in the spinal fasciculi, it is best to do so with an extreme reserve, for the facts known up to this day, and those which I have observed, indicate that the same alterations present in these two classes of organs marked differences, above all as regards their course and terminations. The white tissue of the cord seems to be much more delicate than that of the nerves; and a compression which, applied to a nerve, would pass unperceived and would be, at any rate, incapable of altering its structure, suffices to produce in the spinal cord a secondary degeneration. Besides the work of destruction of the tubes requires in the cord much more time than in the nerves; the granular condition lasts a much longer time; and finally if the regeneration of medullary fasciculi is possible, as I think it is, it advances much more slowly than that of the nerves.

L. Türcke, who seems to have been the first to submit secondary degenerations to a microscopic examination, has not given the details relative to the condition of the nerve tubes. He only points out the presence of a great number of granular bodies and free molecular granulations in the diseased tissue which are thus transformed *in situ*. We cannot adopt this manner of seeing it, and we think that we have, at least at the commencement, not a disease of tissue but an alteration of element. In two cases of recent compression of the cord (one of a duration of fifteen days and the other of six weeks) I was able to see, by examining the degenerated fasciculi in a fresh condition, that a certain number of tubes were clearly in a state of segmentation; fissure, more or less deep, divided the neurilema transversely. At certain points of the preparation, these fragments were infiltrated with fatty granulations; others had been already partly destroyed by the retrograde work which gave the tubes a separated and notched appearance. Independently of the fatty granulations contained in the altered tubes, a large number were free among the elements, and at certain points they were agglomerated in a mass, in such a manner as to form what are known under the name of the granular corpuscles of Gluge.

In these cases, a fine section, made perpendicular to the axis after a maceration of some hours in alcohol, showed in the diseased fasciculi a large number of granular bodies scattered about under the form of black spots. All about these collections, the tissue had a healthy appearance, but the vessels presented on their surface lines of fatty molecular granulations or even a complete envelope which rendered them black and opaque under the microscope. In more advanced cases, where there were descending alterations, as a result of cerebral softening dating from six months to one or two years, I found, by lacerating the tissue of the diseased fasciculi while in a fresh condition, that the nerve tubes were healthy or slightly varicose, and that they were separated from one another by a small quantity of amorphous material, which was usually soft, transparent and, as it were, gelatinous, enclosing numerous fatty granulations, granular corpuscles in greater or less number, and also nuclei analogous to those which exist normally in the gray substance of the nervous centres, and which M. Robin has described under the name of myélocytes. These nuclei were never very numerous; but they were the more abundant in proportion as the alteration was of older date. The appearance of the sections made after some hours' maceration in alcohol, did not materially differ from that which I have described for the first cases. We saw in the midst of a tissue which appeared almost healthy, granular bodies in variable numbers, and the vessels had a more or less atheromatous appearance. But the sections obtained from the same cord, after a maceration of some weeks in a weak solution of chromic acid, showed a notable difference between the healthy and diseased parts. Examined under a low power, the preparation showed in the altered portions bright striæ or transparent points disseminated between the tubes which, by their opacity, contrasted with the spaces occupied by the amorphous substance described above, and which alone allowed the light to pass easily. In the normal parts, the tubes pressed against one another, everywhere resisted the passage of light, and gave a uniform and sombre shade to the section.

Finally, in a case of compression of the cord, dating back for thirteen years, an examination made in the fresh state showed in the diseased fasciculi a soft, transparent and abundant amorphous matter, studded with myélocytes; and in the midst of it a few tubes, non-granular, but varicose. The fatty molecules were few in number, the granular corpuscles were found only here and there, and the vessels were almost normal. The fine sections made after maceration in chromic acid, and examined with a low power, at once made evident the diseased parts, which contrasted in the clearest manner, by their transparency, with the healthy parts, which preserved their uniform dark tint. Besides, in the altered parts we saw scattered about in the transparent amorphous substance black dots representing the sections of tubes which had not been destroyed. I should add that the connective tissue which had thus taken the place of the nerve tubes had produced, owing to the contractility with which it is endowed, a particular deformity of the cord consisting in a longitudinal depression of the surface at the points nearest to the altered fasciculus.

By comparing these different alterations, and by considering their chronological succession, we can, I think, determine the morbid process in secondary degenerations.

Three principal facts arise from the preceding statement: 1st, the atheromatous appearance of the capillaries and the formation of granular corpuscles in the tissue which has degenerated; 2nd, the alteration, and afterwards the disappearance, of a greater or less number of the nerve tubes; 3rd, the formation of a connective tissue which takes the place of the tubes. Only two inter. pretations seem to me possible. We may suppose that an irritation produced at the point of the primitive lesion is propagated with rapidity through the whole length of the injured fasciculus, but in one direction only, viz.: that of its physiological conductibility; that there hence results a slow inflammation, exactly limited to the parts whose functional activity is no longer called in use, and which cannot spread to contiguous parts; and that this inflammation gives rise to a morbid production of connective tissue which unites the nerve tubes, vitiates their nutrition, and at last causes their disappearance.

Under this hypothesis we might, with M. Robin, consider the corpuscles of Gluge as leucocytes which have undergone the granulo-fatty alteration.* Under another hypothesis which I hope to make more worthy of acceptance, the tubes injured in one point of their course are primarily altered in all that portion which has lost its connection with their centre of origin, without there being any trouble of nutrition in the tissues which they pass through. Every thing then goes on as it does in the peripheral end of a divided nerve. The substance of the tubes is changed into fatty granules which are diffused through the tissue, some isolated, others accumulated in masses, (granular corpuscles,†) or in lines along the vessels, (atheromatous appearance of the capillaries.) The nutritive activity of the tissue is stimulated to action by this foreign substance which infiltrates it, absorption commences and causes it to disappear little by little, while at the same time proliferation of the connective tissue fills up the vacancies.

The first hypothesis seems to me liable to very grave objections. Independently of the fact that there is something strange in imagining an inflammation which should develope itself on one side only of the primary lesion, and always on the same side, which should spread rapidly through the whole length of a spinal fasciculus without manifesting itself by any symptom, and which, in this sudden extension, should limit itself to a very narrow band without encroaching upon contiguous parts, which notwithstanding have intimate nutritive relations with the diseased parts, by their nervous and vascular connection, we should suppose that the microscope should

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* It is seldom, except in inflammatory softening, that we can attribute to leucocytes the origin of granular corpuscles.

† It may be that certain granular corpuscles are the result of the granulo-fatty transformation of drops of the white substance of Schwann.

show proliferation of the connective tissue before showing the alteration of the tubes. Now this is contrary to what we observe. The first lesions which we see are the segmentation and the retrograde alteration of the tubes; the morbid production of connective tissue is secondary, and occurs much later.

On the other hand, if the increase of connective tissue was the initial phenomenon causing as its consequence the disappearance of the tubes, secondary degeneration would be nothing more than a sclerosis, and should have the character of sclerosis. We know that, in this latter affection, the proliferation of connective tissue strangles the nervous elements, vitiates their nutrition, and causes their atrophy and disappearance; but this disappearance has an entirely special character: the white substance of Schwann diminishes in thickness, generally in an unequal manner, so as to give to the tubes a varicose appearance; this substance may be entirely absorbed in some parts where the axis-cylinder remains bare; we can then trace it to a point where it disappears in a sheath of medullary substance still intact; then it reappears further on; finally the absorption of the medullary matter of the tubes becomes complete, and we can see the axis-cylinders remaining in the midst of the sclerosed mass, parallel to one another, and similar in appearance to the fibres of subcutaneous cellular tissue, from which they are easily distinguished by the action of certain re-agents. Then, there is direct atrophy of the medullary substance of the tubes; in secondary degenerations there is no atrophy of this substance; it disappears by the necessary intermediation of a process entirely different from atrophy, by a retrograde transformation, and, before being absorbed, it loses its usual appearance, its cohesion, and even its chemical constitution. I may add, that I have never been able to find the denuded axis-cylinders in the case of secondary degeneration, and no observer has remarked their persistence, which we often find in cases of sclerosis. Finally, a new differential character is, that the sclerosed tissue is almost always studded with a considerable number of amylaceous bodies; these bodies are totally absent, or only exist in small quantities in parts attacked by secondary degeneration.

It is not that I do not comprehend the analogy which exists between the proliferation of connective tissue which is observed at an advanced period of secondary degenerations, and the new morbid product which primitively constitutes sclerosis; but we will see what essentially different parts this hypergenesis takes, in the two cases, with regard to the disappearance of the nerve tubes.

Here is the place to make an important remark: in a nerve attacked by secondary degeneration, all the tubes are not altered; some preserve their structure and their functions almost intact; these are those which, already existing at the part primarily injured, have been respected by the injury, or those which have emerged from the gray substance beyond the primary seat of alteration. These tubes, after the disappearance of those which normally surround them, become isolated in the midst of the connective tissue which is undergoing proliferation, and which by its contact cannot fail to modify their vitality. In fact they become varicose, just as is seen in sclerosis. It is on account of these considerations that I have, in a former work,* described secondary degenerations under the name of secondary sclerosis or false sclerosis, in contradistinction to primitive sclerosis or true sclerosis.

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* De l'Alãxie locomotrice progressive au point de vue de ses lesions anatomiques et de ses rapports avec diverses maladies peu connues de la moelle épinière. (Journal de Medicine de Lyon, Novembre, 1864.)

To finish with the processes of secondary degenerations, I ought yet to say a few words about the vascular alterations observed in the diseased tissue. I have already pointed out the atheromatous appearance of the capillaries; it is observed almost constantly, but in very variable degrees, and this fact, added to other characters indicated further on, seem to justify the comparison which M. Gubler* has made between secondary degeneration and chronic cerebral softening. The yellow, depressed patches which are so often met with on the surface of the brains of old persons, present in a peculiar degree all the histological alterations which we have described, but in a much more marked form. It is not probable that the morbid process, although producing similar results, is the same in the two cases. Although pathological anatomy and experiment have thrown light upon certain points of the pathogeny of cerebral softening, the mode of formation of these yellow patches is far from being understood. As for the atheromatous condition of the capillaries which is found so constantly and to so great an extent in this affection, we know not whether it is the product or the cause of the disease. In secondary degeneration, this condition of the vessels seems to me to be consecutive to the alteration of the surrounding tissues.

And first, it is not the result of senile degeneration, for I have succeeded in finding it in a very advanced degree in very young children, as a result of compression of the cord by Pott's disease.† The fatty condition of the capillaries is only the consequence and the index of an alteration of nutrition of that portion of the tissue which has lost its physiological activity; therefore it is only the indirect consequence. I could with difficulty comprehend that a capillary vessel should become fatty only because the neighboring nerve tubes do not perform their functions; but if the neighboring nerve tubes are greatly modified in their structure, it may be that the abnormal materials of disassimilation which they give up to the capillaries, may produce a secondary trouble in the vitality and structure of the latter. Besides, the alteration with which we are occupied, does not seem to me to have advanced to this degree. If I am not deceived, there is only an atheromatous appearance, and not a fatty transformation of their substance. During the early period of secondary degeneration in young subjects, the abundant fatty granulations appear to me to envelope the vessels rather than infiltrate them; they seem to be external to the membrane proper of the capillary vessel, which latter does not appear to be perceptibly modified. I have even demonstrated in several cases that they were accumulated between that membrane proper and its envelope of connective tissue, in that intermediate space to which M. Robin has called attention. I do not deny that these facts should be examined into: for the interpretation which I propose is founded upon only a limited number of cases. At all events it seems to me to give a satisfactory explanation of the facts observed,

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* Loc. cit. (Archives gén. de Med., t. 11, p. 31: 1859.

† I should protect myself against the charge which might be brought against me of having described, as atheroma of the capillaries in children, a condition of the vessels of the brain usual at

that period of life, a condition characterized by the presence along the capillaries of little refracting beads and granulations which are evidently situated in the lymphatic interspaces described by M. Robin, and which, by their disposition in lines or their accumulation at certain points, principally in the angles of bifurcation, may resemble in a superficial examination, the atheromatous alteration.

and of their evolution, since the atheromatous appearance, very marked at a certain period, seems afterwards to diminish, so that when the connective tissue is completely formed, the granular corpuscles and molecular granulations have in a great measure disappeared from the diseased part. This theory of the atheromatous alteration of the capillaries of the nervous centres could not be peculiar to secondary degenerations, for it enters into that general law expressed by Billroth, as follows:* "The fatty degeneration of the capillaries of the brain, or rather their envelopment in fat, is the consequence not the cause, of a defect of nutrition in the central nervous tissue."

One could object to the theory which I have just given of the primitive granular fatty degeneration of the nerve tubes of the cord that, in nerves where this alteration has been studied to better advantage, the observed phenomena differ materially from those which I have described above. This is because, in the nerves, each primitive fibre is contained in a solid and resisting envelope, which is wanting to the tubes in the nervous centres. In the nerves, the fatty granules resulting from the transformation of the substance of Schwann remain imprisoned in this envelope, and cannot distribute themselves in the surrounding tissue as they do in the cord. This anatomical peculiarity seems to me sufficient to explain the differences of appearance which the same alteration presents according as it is in one tissue or another.

It would still remain to study the regeneration of nerve tubes in the spinal fasciculi which recover their functions after having been affected by secondary degeneration. But the materials for this study are completely wanting; and, in a general way, we may say that the regeneration of spinal fibres has never been established by any direct observation. On one occasion, MM. Charcot and Vulpian thought they preceived the traces of reproduction of the nerve tubes in a case of sclerosis of the posterior columns. This appearance has never even been mentioned among the results of secondary degenerations; and if I said above that I believed in the regeneration of the nerves of the cord after these alterations, it was because I relied upon clinical considerations which I shall treat of hereafter.

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* Theodor Billroth, Ueber eine eigenthümliche gelatinöse Degenration du Kleinhirnrinde nebst einigen Bemerkungen über die Beziehungen der Gefässerkrankungen zur kronischeu Encephalitis (Archiv-der Heilkunde Dritter Jahrgang, p. 47.)

I should now point out the methods of investigation applicable to anatomical study of secondary degenerations.

Direct inspection often allows us to seize upon certain peculiarities which may put us upon the track of this alteration. Thus in descending degenerations, a result of some old brain affection, it is not uncommon to find the peduncle of the diseased side smaller than that of the other; we then remark, after having removed it envelopes, that its color is changed, it presents on its inferior aspect a line of a yellowish gray in the course of its fibres, of greater or less size, situated sometimes at its internal, sometimes at its middle and sometimes at its external part, according to the location which the primitive alteration occupies in the hemisphere. In these cases it is not uncommon for the pons to present a more or less marked flattening on the same side. The medulla oblongata, deprived of its membranes, also shows a marked difference between the two anterior pyramids. The pyramid of the diseased side is, like the peduncle, small and yellowish. This atrophy of the pyramid renders the olivary body of the same side more protuberant, and might lead us to think there was a disease of this organ.

As a general rule, the consistency of the degenerated parts is not changed; but in one case M. Gubler noticed a softening of this tissue.

As for the cord, an external examination rarely furnishes any indications, unless it be in very extensive and very old alterations of a hemisphere, and more particularly in cases of cerebral agenesis. We then find a diminution in size of that half of the cord opposite to the diseased hemisphere. In cases of the same kind, if the atrophy of one half of the cord is not evident, we observe sometimes a slight deformity of the organ consisting in a longitudinal depression in one of its lateral parts, a little in advance of the posterior roots. This lesion, however, cannot be well traced unless the cord has been previously hardened.

Seen through its membranes, the cord does not present any modification of color at the situation of the altered fasciculi; even when the membranes are detached without affecting its tissue, its color appears to be normal. But, if we make a section of the organ in a direction perpendicular to its axis, we can often see that certain portions of the white columns have not the same appearance as the healthy parts. It is sometimes a yellowish gray tint, sometimes a semi-transparent, bluish gray tint, like that of milk diffused in water; and sometimes again it has the gelatinous grayish coloration of sclerosis. The yellowish color is principally observed in cases of degeneration with an abundance of granular bodies, that is to say in cases of not very long standing. Nevertheless, and I should insist upon this point, an examination of the diseased tissue of the cord with the naked eye is usually incapable of leading us to suspect even quite marked alterations.

After this preliminary inspection, and before submitting the cord to any preparation, it is best to examine with the microscope some portions of its tissue, removed with small curved scissors, from the parts supposed to be diseased. These fragments teased out in a drop of water, should be examined with a power of from 150 to 300 diameters. We thus recognize the condition of the tubes, the atheromatous appearance of the capillaries, the granular corpuscles, the molecular granulations and the starch bodies. We then replace the water of the first preparation by a few drops of a weak solution of carmine whose alkalinity has previously been neutralized by acetic acid. The amorphous matter interposed between the tubes then becomes plainer, nuclei appear, and the capillaries are made more visible. All these details may be made still more precise by the addition of a drop of acetic acid, after having taken the precaution to remove the excess of carmine by washing with pure water. It is often more expeditious to replace the carmine by an aqueous solution of fuchsine with or without the addition of acetic acid.

After these primary investigations, the cord is placed in alcohol at 36° C., and after a few hours it will have accquired a sufficient degree of firmness to enable us to make quite thin sections perpendicularly to its surface. By treating these sections with acetic acid, compressing them slightly between two glass slides, we can ascertain, with a power of from 80 to 120 diameters, at what precise points the granular corpuscles and atheromatous vessels are situated. This preparation cannot give other indications; but we can renew the first examinations which I have mentioned above, on the portions of the cord thus treated with alcohol; the nerve tubes then have sharper outlines, and the observation is less impeded by the beads of the white substance of Schwann which are constantly formed in preparations made with the fresh cord.

The cord is then placed in a solution of chromic acid, and, by the end of two or three weeks it will usually have acquired a sufficient degree of firmness. Then it is not very rare for the greenish yellow color of its section to present, at the points of degeneration, a lighter tint than at the healthy parts; and we can often map out exactly the space occupied by the degeneration, by pouring upon the surface of the section a few drops of a concentrated solution of carmine. By washing this surface, at the end of a minute, with a camel's hair pencil dipped in water, the diseased parts only remain colored with a lighter or darker tint of violet, according as the connective tissue of new formation is more or less abundant.

The examinations of these sections show also the deformities which the cord may have undergone, and allow us to measure very exactly the dimensions of each fasciculus, by appreciating the differences which may exist on one side or the other.

Finally it is best to remove from these hardened cords some very thin slices which, treated first by caustic soda, then by glycerine, show in the clearest manner, even to the naked eye, the altered parts. The latter appear as clear, transparent patches, plainly contrasting with the surrounding tissue which remains opaque; and under the microscope, they seem studded with a variable number of black points, representing the tubes which have not been attacked by the degeneration.

If we wish a preparation of the whole structure which will also serve for a study of the elementary alterations in detail, the section must first be placed in a weak solution of carmine, made neutral by acetic acid; at the end of a few hours, when we consider it sufficiently colored, we wash it with water, then with absolute alcohol, finally we treat it with rectified essence of turpentine, and finish the preparation in Canada balsam.

This mode of preparation is also applicable to longitudinal sections. We see in them the varicose condition of the tubes, which, although comprised in the diseased parts, have been respected by the degeneration, but have been surrounded and then deformed by the connective tissue of new formation.

Thus far, I have studied the secondary degenerations in themselves, without considering the varieties of situation which these alterations may present in the different columns of the cord. The anatomical facts are general; they are applicable to all cases, whatever be the direction in which the degeneration is produced, ascending or descending, whatever be the nature or location of the primitive lesion to which they succeed.

I am now going to commence the especial study of these degenerations, and demonstrate in what direction these lesions are produced, to what columns and what portions of columns they are limited, according as the primary disease is situated in such or such a part of the nervous system. I shall study successively the secondary degenerations of the spinal cord, in consequence of primitive lesions, 1st, of the cerebral hemispheres; 2d, of the cerebral peduncles; 3d, of the pons; 4th, of the medulla oblongata; 5th, of the cord itself; 6th, of the spinal roots. At a future time we shall without doubt form a seventh class for ascending degenerations of the cord in consequence of primitive lesions of the ganglia of the posterior roots; but I do not know that any observation is in existence at this day which can enter into that division.

I. SECONDARY DEGENERATIONS AS A RESULT OF PRIMITIVE LESIONS OF THE CEREBRAL HEMISPHERES.

These degenerations are the first which were discovered. It is to these that the observation given in the Sepulcretum refers; these are those the existence of which M. Cruveilhier suspected; it is these which are referred to in the first exact works published upon this subject by L. Türcke, by MM. Charcot and Turner, and by Schroeder Van de Kolk. Up to this time a certain number of observers have proved facts of this kind; but we may say that the subject, as yet very incompletely known in an anatomical, is not at all understood in a clinical point of view.

We will point out hereafter the symptomatic peculiarities which may be referred to these degenerations. As to the precise seat of the alteration, the numerous facts which we have gathered during the last three years, both at the Salpêtrière, in the service of M. Charcot, or at the hospital Sainte-Eugénie, in wards of M. Triboulet, seem to us to fully confirm the ideas advanced in 1851, by L. Türcke.

But before entering into the details of this anatomical study, some preliminary questions should be decided.

And first, Do all morbid conditions of the hemispheres determine secondary degenerations? Thus proposed, the question ought to be answered in the negative. I have never found a trace of this alteration in simple cases of compression by tumors of the membranes, by effusions into the arachnoid, or by thick false membranes of the dura mater, with meningeal hemorrhages. Even very extensive superficial lesions of the convolutions do not produce any descending degeneration. This lesion is met with, neither in acute meningeal encephalitis, nor in tuberculous meningitis, nor in the diffused meningeal encephalitis of general paralysis, nor in the majority of superficial softenings of the convolutions either red or yellow. But certain lesions of the peripheral portions of the brain which interest the deep layers of the gray cortical substance, and destroy them, such as the yellow patches, and which encroach even upon the subjacent white tissue, may give rise to secondary degenerations which are usually not very marked.* As a general rule these degenerations result from lesions of the central portions of the hemispheres. It is above all in cases of hemorrhages or of softening of the corpora striata that they easily reveal themselves to the observer. Still it is not necessary that the lesion should occupy exclusively the centre of the ganglia of gray substance. There is a remark verified a number of times by M. Charcot and M. Vulpian, that the most manifest secondary degenerations succeed primary lesions which have destroyed to a greater or less extent the little white bands† interposed between the two corpora striata (capsule interne de Burdach.) Lesions of the optic thalami also produce descending degenerations, which however are generally less marked than those which are consecutive to destruction of the corpora striata. Finally, I have observed recently, with M. Charcot, a case of secondary alteration of the cord connected with the existence of depots of cellular infiltration in the centrum ovale. We see that a certain degree of vagueness reigns over this subject, and that the intensity of secondary degeneration, compared with the extent of the primitive lesion and with the exact situation of this lesion, deserves to be studied in a more precise manner. This will be the surest way of knowing what relative quantity of nerve tubes each part of the brain sends directly to the spinal cord, and what location these tubes occupy in the substance of the rachidian axis.

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* See the observation already cited of Egris Valentine, where I have seen evident descending degeneration result from a yellow patch spread over several convolutions, with integrity of the corpora striata and the optic thalami, as well as of the expansions of the peduncles. (Trousseau, Clinique Medic., loc cit.)

† Taenia semi-circularis.

Thus far, the labors of M. Türcke have only determined with exactitude the distribution of the descending degeneration in consequence of cerebral lesions; and if the results at which he has arrived are incomplete, as much in regard to the process of this degeneration as to that of the final evolution which it undergoes, we ought to acknowledge that he has determined with certainty the location which the lesion occupies in the cord. More recent works have added nothing to his description, and the numerous facts which I have been able to collect, have all conformed to the localization which he had indicated. A single fact anterior to his researches bore witness to the correlation which may exist between atrophies of the cord and lesions of the brain; but this fact had not been understood. I would speak of the observation of Wepfer, which I have mentioned before. It concerned a young girl with paralysis of the left arm, who had in the right hemisphere two cavities as large as eggs and filled with a turbid liquid. The corpus striatum and a portion of the corpus callosum were ulcerated. It is said, in the observation that the cord did not fill the rachidian cavity which contained a good deal of sanguinolent serum. The author adds: "*Quae* (the cord) *firma et nitida erat, sinistra tamen pars dextra minor videbatur.*" The history of secondary degenerations of the cord was limited to this phrase, before the works of Türcke. However, Rokitansky[*] had remarked, after a considerable loss of substance of the hemispheres by hemorrhage or inflammation, an atrophy of the peduncle, of the pons Varolii, of the medulla oblongata and of the spinal cord.

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[*] Patholog. Anat., 1re edit., t. e, p. 715.

Thus, there exists an intermediate step between the alteration of the cord and the primitive lesion of the hemisphere. The degeneration is above all marked in the peduncle and in the medulla oblongata. It was that which attracted the attention of M. Cruveilhier, and that which he has described with exactitude. I should say that the succinct description which he has given of it is a resumé of a long observation of facts which have not been published. A single case of descending degeneration as the result of lesion of one hemisphere is given in his Atlas of pathological anatomy;* it is so incomplete that it could not have enabled this author to give the excellent description of secondary degenerations of the medulla oblongata to which I have already referred. The observation to which I allude is that of Jeanne Hamel, who died at the Salpêtrière, the third of January, 1833, at the age of 72 years. This woman had a left incomplete hemiplegia, a paraplegia with rigidity, and showed some defects of intellect. Death was the result of an acute red softening of the convolution. They found in the midst of the cerebral substance several little cicatrices of former effusions and linear induration in the substance of the left peduncle. The pons was a little deformed, the median line prominent, the lateral portions depressed; it contained in its substance, on the right side, a little cellular cavity; the cord was indurated. We might ask if any one of these lesions is the result of a secondary degeneration. The induration of the left peduncle could not be considered as a descending altertion, from the fact that it was indurated; besides it is not stated whether there were marks of disease in the left hemisphere; finally in this case the hemiplegia should have been in the right and not in the left side. The cellular cavity of the pons was only the trace of a primary softening. The flattening of the pons on the left side could, alone, be attributed to a secondary degeneration of its longitudinal fibres; but did this degeneration have its primitive cause in the hemisphere or in the peduncle? As for the cord, its induration, which was indicated by the paraplegia, could not in any manner be considered as the result of a descending alteration.

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* Anatomic Patholog., 32 livrais., p. 15.

I have already indicated the characters of descending degeneration in the medulla oblongata. As this is not the object of this work, I will not here enter into fuller details, and I pass to the examination of the situation which the secondary degeneration consecutive to lesions of the hemispheres occupies in the spinal cord.

The alteration which, in the bulb, is limited to the anterior pyramid of the side corresponding to the primary lesion of the brain, penetrates the cord following the distribution which normal anatomy indicates; it follows the decussation of the pyramids, and occupies in the cord the side opposite to the primitive lesion. In all cases where a secondary alteration of the bulb is manifest we find an alteration of the same nature in the antero-lateral column of the cord on the opposite side. But this alteration does not spread throughout the whole thickness of the antero-lateral column; it occupies a precise location in it, it is limited to the posterior portion of the lateral column between the postero-lateral fissure and the ligamentum denticulatum. It is at this point that Türcke found the granular corpuscles; it is there also that the lesion has always seemed to me to be located. In cases of considerable and very advanced degeneration, where a large number of tubes have disappeared and have been replaced by connective tissue, we see the antero-lateral column, healthy in the remainder of its structure, present a spot as if colored by carmine at this exact point which in their sections contrasts by its transparency with the surrounding tissue, and looks like a hole cut by a punch. All around the medullary is normal and we always find a little band of healthy white substance which separates the altered portion from the pia mater. This is the reason why even in cases of very considerable degeneration the external examination of the cord does not allow us to perceive any modification in the color of the altered column, while we can do so in true sclerosis of the lateral columns when the diseased tissue, being in direct contact with the meninges, is recognizable from its peculiar gray tint. However, in hardened cords, we can sometimes see at this point a deformity of the organ, a depression of its surface which forms an abnormal furrow in advance of the line of attachment of the posterior roots. The alteration of the posterior portion of the lateral column, more marked in the cervical region, diminishes as it recedes from the bulb; but we can in most instances follow it throughout a great extent of the cord, sometimes even to the inferior part of the lumbar enlargement.

We know that at the inferior part of the bulb the decussation of the pyramids is not complete, but that a portion of the fibres which compose each pyramid approach the median line so as to form the internal part of the anterior column of the same side. This anatomical fact would lead us to expect that in certain secondary degenerations we should observe, as a result of a lesion of a single hemisphere, a degeneration of the posterior part of the opposite lateral column, and of the internal part of the corresponding anterior column; that is to say a lesion of both sides of the cord. This is what we see in reality. Out of six cases of secondary degeneration consecutive to lesions of the brain, L. Türck has seen, in three, the alteration of the internal part of the anterior column accompanying that of the lateral column of the opposite side. I have had occasion to observe this double degeneration with M. Charcot; but, in a greater number of autopsies, I have only once been able to see the condition of sclerosis which succeeds to the destruction of the tubes, in the anterior column of the side of the cerebral lesion.* In this case the alteration formed a narrow little band, clearly distinct from the healthy tissue, applied to the expansion which the membranes send into the anterior sulcus, and reaching in front, the inner surface of the pia mater, and behind, the anterior face of the commissure. Perhaps my attention has not been sufficiently fixed upon this question; at all events, this alteration of the anterior column seems to me to be rare, besides it is always accompanied by an alteration of the same nature, and more pronounced, of the posterior portion of the lateral column of the opposite side. In order that it should occur, the alteration of the anterior pyramid must be extensive and must interest its external portion. Secondary degeneration of the internal portion of the anterior columns, as a result of lesions of the hemispheres, does not extend through the whole length of the cord. In the case which I have seen, it could not be recognizedat the middle of the dorsal region; but Türck says, that, in two cases, he has been able to find the granular corpuscles as far as the level of insertion of the roots of the last intercostal nerves.

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* I am indebted to MM. Charcot and Vulpian for the communication of an analogous observation gathered by them in 1862.

II. SECONDARY DEGENERATIONS AS A RESULT OF PRIMITIVE LESIONS OF THE CEREBRAL PEDUNCLES.

The absence of proper documents will oblige us to make this a brief chapter. A single observation has been published up to this day; still it may be disputed whether it was secondary degeneration. It had reference to a fibrous tumor of the left cerebral peduncle in an epileptic. The case was presented to the Society of Biology by MM. Cornil and Thomas.* The tumor had produced an atrophy of the peduncle, and this atrophy extended to the pons and to the anterior pyramid of the same side. The tissue of the atrophied parts presented no analogy to that of the tumor; it was in every respect similar to that of parts affected by sclerosis, the posterior columns of those suffering from ataxy, for example; no granular corpuscles were met with. It may be that this was not a secondary degeneration at the period of proliferation of connective tissue, but a sort of chronic inflammation of the peduncle occasioned by the tumor, an inflammation which would be propagated in the direction of the fibres of the part, just as is usually observed in primary sclerosis. At all events, the condition of the cord has not been given in the observation.

I have recently seen, in an autopsy made at the Salpêtrière, two symmetrical points of softening in the cerebral peduncles, the pons was flattened on each side of the median line, and the anterior pyramids presented the atrophy and the yellowish gray color characteristic of secondary degeneration; but a microscopic examination was not made, and the cord was not examined.

III. SECONDARY DEGENERATIONS AS A RESULT OF PRIMITIVE LESIONS OF THE PONS.

Observations are still more completely wanting on this subject. A single case, although very incomplete, seems to us worthy of being mentioned. I borrow it from the Atlas of Pathological Anatomy of M. Cruveilhier.* Marie Duffet, aged 57 years, died at the Salpêtrière, June 3, 1834. Was hemiplegic on the right side; motion was entirely lost on this side, and there was an incomplete loss of sensibility. The members of the left side were not possessed of their natural power of motion. At the autopsy the brain was found to be healthy; but in the pons was discovered an old apoplectic depôt implicating both sides, more extensive superficially on the right, but deeper on the left. The anterior pyramids were atrophied, especially the left.

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* Comptes-rendus de la Societé de Biologie, 1864, p. 46.

The plate which represents this lesion being inexact, I cite word for word the correction of the author: "The anterior pyramids were atrophied to such a degree that, in my notes taken at the time of the examination, I have written: 'No anterior pyramid on the left side, the right anterior pyramid atrophied.' On this account I ought to correct the figure, which, having been finished in my absence, resembles the normal condition a great deal too much."

Finally it is said in the observation that the cord was healthy.

Although incomplete, this observation at least proves that the intensity of the secondary degeneration is the more pronounced as the primitive lesion is nearer the bulb.

IV. SECONDARY DEGENERATIONS AS A RESULT OF PRIMARY LESIONS OF THE BULB.

In proportion as the primitive lesion approaches the spinal cord, the secondary degeneration of this nervous centre ought to become more marked and more complicated: every deep lesion of the peduncle, of the pons or of the bulb ought to produce an alteration not only of the tubes which have their origin in the altered part, but also of those which, commencing higher up, pass through that part and are there injured in one point of their course. This increasing complication of secondary degeneration could not have been treated of in the preceding paragraphs, since in none of the cases of primary alteration of the peduncles or of the pons Varolii which we have mentioned, has the condition of the cord been studied. It is not so in primary lesions of the bulb; but these cases are rare, for the alterations of this part of the nervous centres generally produce death before the degeneration has had time to become developed. We have not found in the authors any observation which can instruct us with regard to the disposition of descending degenerations consecutive to primary lesions of the rachidian bulb. The description which we will give of them rests solely upon two observations, of which one was taken by us at the hospital Sainte-Eugénie, the other was sent to us by M. Charcot.

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* 21 livraison, pl. v., fig. 3.

The first case regarded a little girl of five years, affected by cervical arthritis. An abscess produced by caries of the axis softened in front of the dura mater, and lifted this membrane even in the interior of the cranium for two centimetres in front of the occipital foramen. The bulb was compressed and flattened from before backwards by this collection of fluid, and, besides, an inflammation, which, had caused adhesions anteriorly between the arachnoid and dura mater, had implicated even the tissue of the bulb, the superficial portion of which was the seat of a red inflammatory softening. Death, which was the result of this inflammation, occurred about fifteen days after the commencement of the paralytic symptoms which we could attribute to the compression. Several sections made at different parts of the cord at points which were neither compressed nor inflamed, showed, in the fresh condition, numerous granular corpuscles throughout the whole of the antero-lateral columns accumulated especially in the posterior half of the lateral columns. The capillaries presented in a marked degree the atheromatous appearance; there was not as yet any proliferation of the the elements of connective tissue. The posterior columns were perfectly healthy.

In the second case, the bulb was compressed by a dry arthritis; the new formations of bone narrowed considerably the occipital foramen, and a marked thickening with increased length of the odontoid process diminished still more the free space occupied by the bulb. The compression was exerted especially upon the anterior and left lateral portion of this organ; the point most compressed appeared to be the inferior part of the left pyramid, immediately above the decussation. The commencement of trouble dated back one year, therefore there was an abundant production of connective tissue in place of portions of the cord secondarily degenerated. These anatomical specimens have been presented to the Society of Biology, by M. Charcot, and we owe to his kindness the opportunity of renewing upon this cord, preserved in chromic acid, the examination which had been made by him in the fresh condition, at the time of the autopsy, and afterwards upon thin sections, after hardening the organ.

In the fresh condition there was seen by the naked eye, thoughout the whole extent of the rachidian axis, a gray coloration of the posterior portion of the right lateral column, in the seat of election of secondary degenerations consecutive to cerebral lesions. This gray tissue was composed of varicose tubes, an amorphous transparent granular matter, numerous oval or spherical nuclei and amyloid bodies. The sections made from the hardened cord showed at this point a diminution of the tubes; but this transparent spot due to the accumulation of connective tissue of new formation, did not resemble a simple hole, it reached the inner face of the pia mater; besides, the neoplastic production continued along the surface of the antero-lateral columns and penetrated into the anterior sulcus, thus showing a destruction of the more superficial tubes of these columns on both sides. Finally at the posterior portion of the left lateral column a rarefaction of the tubes could be seen as on the right side but less considerable. This degeneration of the left lateral column was not recognizable in sections made in the fresh condition. I should add that, on both sides, but above all on the right, the proliferation of connective tissue of the posterior and external portion of the lateral columns had implicated for a very short distance the contiguous portion of the posterior columns, between the extremity of the posterior cornua and the collateral posterior sulcus. These different lesions manifested the characters which I have pointed out, only in the cervical region; below the brachial enlargement, only the alteration of the lateral columns was visible, and at the inferior part of the dorsal region, only the degeneration of the posterior part of the right lateral column could be found, which was then seen with the same characters as those of degenerations of cerebral origin; that is to say that the transparent portion occupied by the connective tissue formed a circular hole separated from the meninges by a little band of healthy medullary tissue.

We see that in these two cases the seat of the lesion does not appear to be the same; however, we observe that the degeneration was not limited to the posterior parts of the lateral columns, but that it extended in the substance of the antero-lateral columns. The only difference is that, in the recent case, we found some granular corpuscles in the substance of the anterior column and of the anterior part of the lateral column, while in the case of longer duration we did find that there was, in these parts, an accumulation of connective tissue which had undergone proliferation only at the surface. But we must remember that the new formation consecutive to destructions of tubes, becomes developed and is apparent only in those cases where a considerable number of nervous elements has been destroyed at the same point, while the degeneration of a few isolated tubes suffices to produce granular corpuscles. The alteration of the substance of the anterior portions of the antero-lateral columns may therefore be manifest in a recent case, and not be appreciable in a case of longer duration. This remark is applicable to a very large number of cases of secondary degenerations. It is very seldom that, in cases where death occurs during the first few months after the commencement of a very limited lesion of the brain, we do not find in the cord granular corpuscles or atheromatous capillaries; on the contrary it is often the case that we cannot find any proliferation of connective tissue at the seat of election in even more extensive cerebral lesions when death takes place at a period when the granular corpuscles have had time to disappear. The study of degenerations consecutive to primary lesions of the cord itself is about to furnish us new arguments in support of this mode of considering the subject.

I should still say a word or two about the very limited alteration noticed in the posterior columns of the cervical region in the last observation. Are there some tubes which arise from the bulb, and, following a downward course, occupy the most external part of the posterior columns? in other words, are there, in the posterior columns, some whose centre of nutrition is situated higher up in the bulb or beyond it? All the known facts up to this day and those which we will discuss in the two following paragraphs contradict this hypothesis, and perhaps in this case we have an instance of the propagation to neighboring parts of a formative irritation, the seat of which was in the lateral columns.

In conclusion, we may say, after these two observations, that secondary alterations of the cord depending on primitive lesions of the bulb, affect the whole of the antero-lateral columns with a greater intensity at the surface than in the deeper parts, but that the degeneration implicates the greatest number of tubes in the posterior part of the lateral columns.

V. SECONDARY DEGENERATIONS CONSECUTIVE TO PRIMITIVE LESIONS OF THE SPINAL CORD.

The secondary degenerations of the cord which follow a lesion at a given point of this nervous centre have been observed under very varied circumstances; but it is more especially as a result of compressions of the cord by tumors of the meninges, by purulent collections in the rachidian canal, by fractures of the vetrebral column, and above all by Pott's disease, that they have been studied. They have also been seen to follow diseases of the tissue of the cord as partial scleroses; but these last facts, I should say, are still very obscure. If the original disease of the cord is acute, it seldom gives time for the degeneration to be produced; if on the other hand it is chronic, the alteration of the tubes, even in the locality of the lesion, advances slowly, and the portion which is external to this locality may then gradually become atrophied, in such a manner that the production of the secondary lesion does not appear to be absolutely identical with that which we have formerly indicated.

Every lesion of the cord at one point of its course destroys, by descending degeneration, not only the fibres which come directly from the different parts of the brain, but also those which have arisen from the gray substance of the cord above or at the level of the part injured. The descending degeneration then presents the greatest complications. On the other hand, the posterior columns, injured at one point of their course, degenerate on one side of the point primitively altered. This alteration of tubes whose centre of nutrition is at their inferior extremity, gives rise to ascending degenerations which we will constantly find in the posterior columns, and sometimes in a certain part of the lateral columns.

I shall first study the descending alterations: they have the greatest analogy to those which result from primitive lesions of the bulb. This descending degeneration has been observed quite a large number of times by L. Türck. His first memoir* contains three cases of it; two years later he reported in detail twelve new cases.† In the majority of the cases it was connected with compressions of the cord by Pott's disease. Below the primary lesion, the posterior columns were always found perfectly normal; the degeneration affected exclusively the antero-lateral columns which were seen to be studded throughout their entire substance with granular bodies, accumulated principally at the posterior part of the lateral columns. Passing from the point primitively injured, and approaching the cauda equina, it was found that the alteration of the anterior columns, and of the anterior part of the lateral columns, diminparation employed did not allow of any search for the existence of granular bodies, which, considering the long duration of the lesion, had probably disappeared. As for the atrophy of the anterior columns and of the anterior portion of the lateral columns, it apparently resulted from the disappearance of a large number of nerve tubes, which disseminated through these fasciculi, had allowed the tissue to contract upon itself without leaving any empty space between the elements which remained.

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*Ueber secundäre Erkrankung, etc. (Comptes-rendus de l'Acad. des Sciences de Vienne, Mars, 1851.)

† Ueber secundäre, etc. (Comptes-rendus de l'Acad. des Sciences de Vienne, Juin, 1853.)

The following year I had an opportunity of taking at the hospital Sainte-Eugénie, in the service of M. Triboulet, the observation of a little girl of thirteen years, affected with caries of the vertebræ at the lower part of the dorsal region. Death occurred about six weeks after the commencement of the paralytic symptoms which were the result of the compression of the cord by an intra-rachidian abscess. The portion situated below the point compressed showed a perfect integrity of the posterior columns, but numerous granular bodies were found through the substance of the antero-lateral columns, especially at the posterior portion of the lateral columns which, at the lower end of the organ appeared to be the only ones altered. No hypergenesis of the elements of connective tissue was found.

M. Charcot has communicated to me an observation of compression of the cord by caries of the vertebræ, taken in 1865, at the Salpêtrière, in which these descending lesions present the same characters. The paraplegia became complete only three days before death; nevertheless granular bodies were already to be found in the lower segment of the cord.

Finally, I have recently had an opportunity of observing at the Salpêtrière, in the service of M. Charcot, a case of compression of the cord produced by a cancerous tumor developed in the posterior lamina of the first dorsal vertebra. Besides this, a collection of pus had softened in the rachidian canal and slightly compressed the cord on its posterior aspect, outside of the dura mater from the situation of the tumor to a point about one inch above the lumbar enlargement. The patient died five and a half months after the commencement of the paraplegia. All the columns were altered in the compressed portion; but below, in the lumbar enlargement, the posterior columns were healthy, while the lateral columns contained a considerable number of granular bodies, and a finely granular amorphous material, in which was found a large number of myélo cytes and other very elongated nuclei, resembling embryoplastic nuclei. In the anterior columns also granular bodies were found, relatively much less numerous; besides there were seen, between the nerve tubes, some myèlocytes and embryo-plastic nuclei as in the lateral columns, but in reality much less abundant.

From all these facts, it is clearly evident that, in cases of primitive lesion of the cord, the descending secondary degeneration occupies exclusively the antero-lateral columns; that the posterior columns always remain intact; that, in the antero-lateral columns, the principal and most extensive alteration is limited to the posterior portion of the lateral columns; and that the anterior columns and the anterior portions of the lateral columns also degenerate, but that, in these fasciculi, the degeneration rapidly diminishes, so as to disappear entirely at a short distance from the part originally injured.

Let us proceed now to the study of ascending degenerations of the cord consecutive to primary lesions of that organ. These degenerations have been observed eleven times by Türck. They implicate the posterior columns and the posterior portion of the lateral columns. The anterior columns above the point primitively injured have always been found healthy.

The alteration of the posterior columns, which may occupy the entire surface of the section immediately above the lesion, gradually becomes narrower in proportion as it approaches the bulb, and leaves, at its external portion, the medullary tissue perfectly healthy. The granular bodies are become more and more limited to a zone which rests upon the posterior sulcus and upon the posterior surface of the cord. In the cervical region, they are only found in the smaller fasciculi, and the lesion disappears at the level of the floor of the fourth ventricle.

In the lateral columns, the granular bodies occupy the same situation as in the descending degenerations; but their number progressively diminishes as they approach the bulb. At this level, in place of affecting the anterior pyramid of the opposite side, as is observed in descending degeneration, they continue their course in the restiform body of the same side, pass upwards behind the olivary, and can once more be found at the insertion of the restiform body to the cerebellum, without having undergone any decussation in the substance of the medulla oblongata.

In the case of compression of the cord in a little girl, which I have reported above from Leyden, there was also an ascending degeneration, but this lesion implicated only the posterior columns; the nerve tubes were diminished in number and separated by a transparent material, just as in in the gray degeneration of the posterior cord in persons affected by ataxy. In the case presented by M. Cornil to the medical society of observation, it is said that they found above the point compressed some granular bodies in the posterior columns and in the neighboring portion of the lateral columns.

In the second case of M. Cornil, they also found that the posterior columns, above the lesion, presented a very large number of granular bodies, and they also found some of them in the antero-lateral columns, principally in the course of the vessels.

In the patient of M. Vulpian, who has been the subject of a communication to the Anatomical Society, I have found one of the most manifest ascending degenerations occupying exclusively the posterior columns. Numerous sections, made at different levels above the point compressed, gave me the following results: Immediately above the lesion, we find the tubes diminished in number throughout the whole substance of the posterior columns; a little higher up, we find upon each side a little band of healthy tissue applied upon the internal face of the posterior cornua; the alteration occupies all the remainder of the posterior columns, and presents altogether the figure of a trapezium, the two parallel bodies being formed, one in front, by the gray commissure, another, behind, by the meninges, the two others being parallel to the posterior cornua. In proportion as we depart from the primitive lesion, these two last borders approach one another more, at the same time that the little bands of healthy tissue, situated at the external parts of the posterior columns, increase in thickness. At length these two borders end by uniting in front at the junction of the commissure with the posterior sulcus. At this point, the altered portion appeared upon the section like the figure of an isosceles triangle, the base of which was behind on the meninges, the summit on the middle of the commissure, and the posterior sulcus formed the perpendicular dropped from the summit to the middle of the base. A little higher up, the lesion still preserved its triangular form, but it continued growing more contracted; the base which rested upon the posterior part of the organ, diminished in length, and the summit left the commissure so as to approach little by little the base, following down the posterior sulcus; at length the alteration terminated at the level of the fourth ventricle. In this patient, the lateral columns presented no abnormal appearance.

In the little girl of thirteen years of whom I made an examination at the hospital Sainte-Eugénie, the granular bodies were seen only in the posterior columns above the tumor.

In the observation of recent compression by vertebral caries, which was communicated to me by M. Charcot, the granular bodies were also only found in the posterior columns above the point compressed.

It is not the same in the case of paraplegia from cancer of the vertebral column, recently observed by M. Charcot; the ascending degeneration affected at the same time the posterior columns and the posterior part of the lateral columns; it was characterized by the presence of granular bodies, of isolated fatty granulations, in large numbers and by the atheromatous appearance of the vessels in these parts.

We may conclude from an analysis of the preceding facts, that ascending degenerations of the cord are developed consecutive to primary injuries of that organ, and these secondary degenerations principally affect the posterior columns; that in these columns they gradually diminish in intensity, become limited little by little to the internal and posterior fasciculi, and terminate in a point at the floor of the fourth ventricle.

The alteration of the posterior part of the lateral columns is not mentioned in all the observations. It may be remarked, in this connection, that in the cases of Türck, in which this alteration was present, the primary lesion was located quite high up the cord, at least above the middle of the dorsal region.

In one of the observations which I have taken, the cord was compressed just above the lumbar enlargement, and the lateral columns were intact. In another case this lesion was wanting, and the injury was located below the middle of the dorsal region. In the only case where I have found the lesion of the lateral columns, the compression was due to an alteration of the first dorsal vertebra. It would appear that the height of the primary lesion is not without influence on the alteration or integrity of the lateral cord from ascending degeneration. At all events this degeneration is of frequent occurrence and continues upward in the restiform bodies. Let us add in conclusion, that the anterior columns and the anterior part of the lateral columns are never altered by ascending degeneration.

VI. SECONDARY DEGENERATIONS CONSECUTIVE TO PRIMARY LESIONS OF THE POSTERIOR ROOTS.

Another ascending degeneration of the cord is observed as a result of primary lesions of the posterior roots; but we know of only one case which demonstrates this alteration: it was found in the ward of M. Trousseau, and the anatomical preparations have been presented to the society of biology by M. Cornil. An intra-rachidian tumor compressed the cauda equina without touching the cord; the nervous alteration implicated equally the anterior and the posterior roots; but as far as regards the secondary degenerations of the spinal cord, we may neglect the alteration of the anterior roots, which, according to the results of Waller's experience, degenerate only in the direction of the periphery. The posterior roots, on the contrary, injured above the ganglia which are annexed to them, should degenerate in the centripetal direction. This is what was found in reality. Besides, the cord presented throughout its whole length a diminution of the tubes of the posterior columns. This rarefaction implicating the whole of the posterior columns at the level of the lumbar enlargement diminished gradually in intensity as it ascended, and became confined to the internal and posterior portions of the posterior fasciculi. However, the form of the alteration upon sections made at different levels was not identical with that which we have indicated for ascending degenerations from primary lesions of the cord itself. In place of being, as in the latter case, bounded laterally by two diverging straight lines, nearer one another in front than behind, the degeneration from injury of the cauda equina was circumscribed by the arc of a circle, the convexity of which was turned forward towards the commissure, and the two extremities of which rested upon the posterior face of the cord. The degeneration disappeared at the level of the floor of the fourth ventricle.

Before coming to the study of the functional troubles by which secondary degenerations of the cord betray themselves, we may deduce from the facts already demonstrated some conclusions relative both to the intimate nature of the process of these degenerations and their proximate causes, and to the normal structure of the spinal cord.

OF THE PROXIMATE CAUSE OF SECONDARY DEGENERATIONS.

We have already demonstrated that inflammation plays no part in the production of secondary degenerations of the white fibres of the cord; it only supervenes consecutively, if we may give the name of inflammation to that slow production of connective tissue which produces, so to speak, the cicatrization of the degenerated column. We have established the fact that the first alteration affects the nerve tubes which undergo a granulo-fatty transformation analogous to that which has been observed in the peripheral portion of divided nerves. We have shown the analogy of this destruction of the nervous elements of the cord with that which is observed in cerebral softening from vascular obstruction, and we can now affirm the identity of the destructive process in secondary degenerations, and in degenerations of the nervous centres depending on arrest of the arterial circulation. In both cases there are found, after the first few days, granular bodies and a great abundance of fatty molecular granulations; the origin of these elements appears to be, in the softening as well as in the secondary degenerations, a destructive alteration of the nerve tubes. Some months since, I had an opportunity of observing with M. Charcot, in two cases of recent cerebral softening, the granulo-fatty infiltration of the cylinders of myeline of several tubes taken from the very seat of the softening, and presenting the same characters as those which I had been able to find at the commencement of secondary degenerations. But, when it is the result of a loss of the supply of blood, this destructive process seems to progress with more rapidity; it is for this reason that MM. Prevost and Cotard* have, in their experiments, been able to find numerous fatty granulations thirty-seven hours, and granular bodies three days, after the obliteration of a cerebral artery. They have also seen an atheromatous condition of the capillaries developed in points where they artificially produced a softening by cutting off the supply of blood. I have recognized in man, in a certain number of softenings from arterial obliteration, that this atheromatous condition of the capillaries is, as in secondary degenerations, only an atheromatous appearance; the fatty granulations are, outside of the proper wall of the vessel, accumulated between that membrane and the lymphatic sheath. Finally, as the last analogy, let us state that, in softening from a defective supply of blood, as well as in secondary degenerations, a proliferation of connective tissue usually follows the destruction of the nervous elements, in that period of cicatrization of which M. Durand-Fardel has given so excellent a description.

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* Société de biologie, janvier, 1866. (Gaz. Méd. de Paris, 1866, *passim.*)

Thus the same disturbance of nutrition producing a necrobiotic destruction of nerve tubes may be produced under the influence of two different causes, the loss of the supply of blood and the loss of nutritive action.

By the loss of nutritive action, we understand the cessation of the influence which the elements of the gray substance exercise on the nutrition of the nerve tubes, thus admitting the conclusions to which his experiments on the degenerations of the nerves have conducted A. Waller. We know that according to this physiologist, each tube of the peripheral nerves has at one of its extremities a nervous cell, which, independently of its special properties of innervation, has the function of presiding over the nutrition of the nerve tube which departs from it, and even of contributing by a peculiar influence to the reproduction of this tube, when it becomes degenerated at some point of its course.* These cells Waller has designated under the name of neurogénotrophes; we now call them more simply *cellules-trophiques*, (nutritive cells.)

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* We should perhaps say with more precision at this time, that the centres exert a certain influence on the restoration and not on the regeneration of nerve tubes. It seems to result from the researches of M. Schiff, and of MM. Philipeaux and Vulpian, that the return of the functions of a divided nerve is produced, not by the production of new tubes in the midst of the débris of the de-

I cannot here refrain from examining an opinion which would tend to throw doubt upon the existence of these nutritive cells, or rather to deny the nutritive action which the nervous cells can exert upon the nerve tubes which arise from them. Under this hypothesis, the fatty degeneration of the nerve tubes could only be attributed to functional inertia. Reciprocally, if we admit that functional inactivity is capable of producing degeneration of nerve fibres, it is useless to accord to the central elements any influence whatever upon the nutrition of the tubes; this property would be superfluous, and for the cord, would cease to be demonstrable. Let us consider, then, whether the facts known up to this day permit us to admit that the nerve tubes can degenerate from the sole fact of functional inactivity.

If we cut a mixed nerve, the central extremity remains healthy; on the contrary the peripheral end degenerates, and the alteration implicates all the fibres, sensor and motor. If we consider only the motor fibres, the degeneration affects in truth only the trunk of those fibres, which no longer receives any impulse from the brain or the cord, which are consequently in a state of functional inactivity. It is the same when we divide the anterior roots; the extremity attached to the cord, and which receives from it motor excitation, remains healthy; the peripheral extremity, which no longer participates in this excitation, degenerates. Thus far nothing proves that the functional inactivity may not be the cause of the degeneration.

In the section of a mixed nerve, we have said, all the

generated tubes, as Waller thought, but rather by the reforming of the white substance of Schwann in the sheath of old tubes, around the axis-cylinder which, according to the same experiments, may remain for a long time, notwithstanding that it undergoes alterations which we are far from understanding.

fibres, and in particular the sensitive fibres, degenerate in the peripheral end; nevertheless, in this portion separated from the centre, they continue to undergo the excitations of contact, of temperature, &c.; they receive impressions which they cannot transmit to the centres; but the proper activity of the nerve tubes is put in play, notwithstanding which these tubes degenerate. On the contrary, the central end, which is certainly removed from all peripheral excitation, which is in the most complete functional inactivity, remains healthy. Now make a section in the middle of the posterior roots, and the degeneration affects the central extremity, the one which is attached to the cord, and which is in functional inactivity, and is entirely absent in the peripheral extremity which is in connection with the intervertebral ganglion, and which continues to receive external excitations. Thus, of the sensor fibres, the degeneration attacks sometimes those which are in functional inactivity, and sometimes those whose physiological activity continues to be provoked, and *vice versâ.* The functional inactivity then exercises no influence over the degeneration of sensor fibres. The degeneration affects only those portions which have lost their relations with the ganglia of the posterior roots, the central or medullary extremity of the posterior roots, and the peripheral ends of nerves.

The condition of integrity of a sensor fibre is therefore neither in the fibre itself, nor in its peripheral extremity which receives the excitations, nor in the cord: it is in the intervertebral ganglion, or, according to the opinion of M. Schiff, near this ganglion.

If the functional inactivity is without influence upon the degeneration or the integrity of the sensor fibres, we may, without pushing the analogy, admit that it is the same for the motor fibres. We then have the right to state that the condition of integrity of a motor fibre is in the cord.

For ease of expression, we may translate these two propositions in the following manner: in nerves, the motor fibres have their nutritive cells in the cord, the sensor fibres have their nutritive cells in the ganglia of the posterior roots.*

If the integrity of the tubes of the peripheral nerves is due to the nutritive centres and not to the alternations of activity and repose, we are right in supposing that it is the same for the tubes of the cord, and that the degenerations which we have studied are due, not to the functional inactivity, but to the suppression of the action of the nutritive elements. Here experimental demonstration is impossible. In truth, in the cord, contrary to that which we have seen for the sensor fibres of the peripheral nerves, the degeneration of the tubes is produced always in the direction of their physiological activity. The antero-lateral columns, which conduct centrifugal excitations, degenerate below the point injured, that is to say, in the portion which is no longer excited; the posterior columns, whose conductibility is centripetal, alter above the point injured, in the portion which is thus reduced to functional inactivity.

But, to place a column of the cord in a state of inaction, it is not necessary to produce a lesion of the column itself; we equally produce a functional inactivity of the fibres of the cord having a centripetal current, by destroying in the peripheral nerves the elements which connect mediately with them. This experiment is realized in amputations. Now, never, as a result of an amputation of the thigh, which nevertheless places in the most absolute inactivity all the fibres which were intended to transmit to the cord, and thence to the brain, the excitations coming from the lower limb, never, I say, has a degeneration been found of the posterior part of the lumbar enlargement, nor of any point of the posterior columns. This observation has already been made by L. Türck. In these cases, the fibres which remain inactive during long years preserve the integrity of their structure, because they have not lost their connection with their nutritive cells.

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* This word nutritive cells expresses more than our actual knowledge allows us to affirm, and perhaps it would be preferable to speak only of the nutritive elements, or still better of the nutritive centres. It is not demonstrated, in fact, that all the nerve tubes owe to their connection with a nerve cell all the nutritive activity necessary to the integrity of their structure. As regards the posterior roots, in particular, all of whose fibres have their nutritive centre in the intervertebral ganglia, it is well established that a certain number of these fibres only traverse the ganglion without contracting any relation with the bipolar cells.

We can conclude then from all this discussion, that in the cord as in the nerves, the nerve tubes are placed under the dependence of the nutritive elements. The direction in which the degeneration will be produced, as a result of a lesion of a column, will indicate to us at which extremity of the tubes the nutritive elements are situated. We are now in a condition to draw from the facts just studied some conclusions relative to the normal structure of the spinal cord.

ANATOMICAL DEDUCTIONS.

In the secondary degenerations which follow primary lesions of the brain, of the cord, and of the spinal roots, the extent, form, situation and course of these degenerations indicate in the most exact manner the normal distribution of the nerve fibres which have been destroyed at the point primarily injured; and permit us also to study very exactly the intimate structure of the white columns of the spinal cord, their origins and their terminations, where the scalpel and the microscope could only after great labor afford results less precise, often even very uncertain. L. Türck, first, sought to draw from the anatomo-pathological facts which he observed some deductions relative to normal anatomy; but he is rather anxious to deduce from it, by an interpretation which I do not think sufficiently strict, the direction of the physiological conductibility of different fasciculi of the cord. M. Gubler* also understood all the advantage that normal anatomy could derive from these facts, when he said in one of the conclusions of his memoir: "Thus the lines of softening in both directions (ascending and descending) studied by attentive observers, will serve to determine the situation and the arrangement of the sensor and motor fibres in the columns as well as in the nervous centres. Here pathology will still afford light to anatomy and to physiology." Besides, this method is not new: it is only the application to the cord of a process employed by Waller in the study of the peripheral nerves, and which he himself designated under the name of a "new method for the anatomical investigation of the nervous system." It is by this method that we have been able to study the distribution and anastomosing filaments of the nerves. I think I may say that there would be every advantage in artificially producing secondary degenerations of the spinal cord, so as to make an experimental application of the Wallerian method to the cord.

We have already seen that lesions of different parts, and even of parts very high up in the brain, determine secondary degenerations which can be traced throughout the whole length of the spinal cord: these degenerations also exist exclusively in the antero-lateral columns. We may therefore conclude that there are tubes in the whole extent of these columns which have their nutritive cells in different parts of the brain. On the other hand, the descending degenerations diminish in intensity as they depart from the bulb; then the cerebral tubes which are prolonged into the cord have not all the same destination, but leave, in their course, the antero-lateral columns, so that only a very restricted number of them remain at the inferior portion of these columns. These fibres which abandon the antero-lateral columns do not escape by the roots; for in no case of secondary degeneration has an alteration of the spinal roots been noticed; we are then obliged to admit that they pass into and terminate in the gray substance.

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* Du ramollissement cérébral atrophique, (Arch. Gen. de Méd., 1859, t. 11, 6e conclusion.)

The descending degenerations from lesions of the brain are not disseminated throughout the whole substance of the antero-lateral columns; they sometimes affect the internal portion of the anterior column on the same side as the primitive lesion, and this alteration of the anterior column disappears in the dorsal region; on the other hand, they always affect the posterior portion of the lateral column of the opposite side, and the degeneration continues as far as the inferior extremity of the cord. We conclude that the decussation of the pyramids is not complete; that some fibres, those of the external portion, which more rarely becomes degenerated, gain the internal portion of the anterior column, applying itself to the anterior sulcus, losing itself from point to point in the gray substance, and that the longest of these cerebral fibres do not go further than the middle of the dorsal region. This collection of fibres which the brain sends to the cord without decussation, and which is situated at the internal part of the anterior column, we will call the direct or internal cerebral fasciculus. As a second conclusion, we may state that the great majority of fibres which the brain sends to the cord decussate below the pyramids so as to become located at the posterior part of the lateral column of the opposite side; that they preserve this position throughout the whole of their descending course; that they insensibly become lost in the gray substance, but that some of them are sufficiently long to attain the inferior extremity of the rachidian axis. This collection of fibres which pass from the brain to the lateral column of the opposite side, we will call the decussating or external cerebral fasciculus.

We have now built up only a small part of the antero-lateral columns; the study of degenerations consecutive to primary lesions of the cord will enable us to complete the description. We have stated that, when the cord is compressed at one point, the antero-lateral columns degenerate below the compressed portion, and that the alteration, though of but slight extent in the anterior columns, and in the anterior part of the lateral columns, is on the contrary very pronounced in the posterior and external portion of these latter fasciculi, and that in this situation it extends to the inferior extremity of the cord. Among the tubes which degenerate below the point compressed, there are some which come from the brain, and these are the ones of which we have spoken above. The direct cerebral fasciculi and the decussating cerebral fasciculi are in truth compressed at one point of their course, as is the remainder of the cord, and ought to degenerate in their inferior portion. It results from this, that at the internal part of the anterior columns, and at the posterior part of the lateral columns, the descending degeneration will implicate the fibres of encephalic origin. As it is only in this situation that there are any cerebral fibres, the degeneration of the remaining portion of the antero-lateral columns interests tubes of another class, tubes which do not come from the brain. The degeneration of these latter tubes follows a descending direction; they therefore have their nutrition cell above the point of compression. This nutritive centre is not in the brain, but it is above the point compressed; it is consequently in the gray substance of the cord above the point compressed.

There are, then, in the antero-lateral columns, independently of the fibres of encephalic origin, other descending fibres, medullary fibres proper, which arise from the gray substance of the cord itself. In order to understand the distribution of these latter fibres, we must recall, in an exact manner, the situation occupied in the cord by the fibres of encephalic origin. To render the description less obscure, I think I should insist more particularly upon the form and position of the decussating cerebral fasciculus. The study of secondary degenerations, consecutive to primary lesions of the brain, has shown us that it is almost cylindrical, and located in the substance of the lateral column at its posterior part, in front of the line of insertion of the posterior roots, in the angle formed by the meninges and the external face of the posterior cornu. It does not come in contact with the pia mater, but is separated from it by other white fibres, in such a manner that, when it has been destroyed by secondary degeneration, the sections of the cord show at the posterior part of the lateral column a hole, as if cut with a punch, in the healthy medullary substance, a narrow band of which separates it from the meninges. In secondary degenerations from lesions of the cord itself, this hole is larger; it has increased in front and on the outside, has come in contact with the pia mater, and is thus transformed into a depression. This is because the degeneration implicates not only the fibres of encephalic origin, but also the medullary fibres proper. And as the depression which maps out the degeneration on sections of the cord, passes on towards the inferior extremity of the rachidian axis, gradually becoming narrower, we may conclude that certain medullary fibres descend, following the posterior part of the lateral columns, and become lost in the gray substance after going a long distance. We have already seen that these fibres have their superior extremity in the gray substance of the cord itself; they then establish relations between parts of the gray axis separated by quite long distances. We will designate these fibres by the name of long commissural fibres.

In compressions of the cord, the descending degeneration does not invade only the internal part of the anterior columns, and the posterior and external part of the lateral columns; the granular bodies are met with in the whole thickness of the antero-lateral column, but their number diminishes insensibly as we go further from the point compressed, and they disappear entirely at quite a short distance below the primary lesion. The fibres which thus degenerate through the whole substance of the antero-lateral columns, after a short descending course, are lost in the gray substance of the cord. They do not come from the brain, but they have their nutritive cell above the point of compression; they then arise from the gray substance of the cord, in which they also terminate at a short distance below their origin. I will denominate them the short commissural fibres.

Still this is not all: we have seen that in compressions which act upon the cord above the middle of the dorsal region a slight ascending degeneration of the posterior part of the lateral columns is observed; that this degeneration pursues its course in the restiform bodies, and even in the inferior peduncles of the cerebellum. We must therefore admit that this posterior part of the lateral columns, where we have already admitted the existence of two kinds of descending fibres, encephalic and medullary, contains also fibres of a third class, but in very small numbers: these should be fibres which have their nutritive cell at their inferior extremity. This nutritive cell we can only suppose to be in two points; either in the gray substance of the cord, or in the ganglia of the posterior roots. But we have seen that lesions of the posterior roots, which suppress the nutritive action of the ganglia for the cord, do not determine ascending degenerations of the lateral columns; we should then admit that the gray substance of the cord sends along the posterior part of the lateral columns some fibres which reach the cerebellum by the restiform bodies and the inferior cerebellar peduncles. In several cases of secondary degenerations, a vain search has been made for the trace of tubes which should go from the restiform bodies, across the deep portion of the pons, in the direction of the optic thalami.

In conclusion, the antero-lateral columns enclose encephalic fibres disposed in two fasciculi, at each extremity, at the internal part of the anterior column and at the posterior part of the lateral column. Besides, they are for the most part formed by descending medullary fibres proper, which establish relations between the different levels of the gray substance, commissural fibres, quite short in the anterior columns and in the anterior part of the lateral columns, much longer in the posterior part of these same columns. Finally, there exists also in this posterior portion of the white anterior substance of the cord, some ascending fibres which establish relations between the rachidian axis and the cerebellum.

L. Türck, to whom belongs the discovery of ascending degenerations of the lateral columns, concluded from this that these columns contained in their posterior portion, fibres with a centrifugal and fibres with a centripetal current. It is possible that the lateral columns may conduct centripetal impressions: certain physiological facts, upon which I may not insist, would tend indeed to make us think so. However this may be, this opinion cannot be legitimately deduced from the examination of secondary degenerations. We can affirm only one thing, which is that some of the fibres of the lateral columns have their nutritive centres at their superior, and some at their inferior, extremity. But the degeneration of a tube is not necessarily produced in the direction of its physiological conductibility: thus the sensor fibres of the peripheral nerves, the functional activity of which is exerted in the centripetal direction, have their nutritive elements at the superior extremity; so that the nutritive influence acts in an inverse direction to the physiological conductibility.

Let us now say a few words about the origin of the anterior roots, before passing to the study of the posterior columns. An experiment of Waller, already mentioned, proves that these roots have their nutritive centre in the cord. We have seen elsewhere that in compressions of the cord the anterior roots never degenerate either above or below the point primarily injured; from this we may conclude that they arise from the gray substance at a point very near their emergence, and that they run only a very short course along the antero-lateral column.

The constitution of the posterior columns seems to be less complex than that of the antero-lateral columns; but, in fact, their degenerations are not so completely known. From the special point of view which we take in this research, we can obtain our information from only two sources: from the study of compressions of the cord, and from that of the lesions of the roots.

Waller, in his experiments upon division of the posterior roots, had already remarked that, while the end attached to the ganglion remained healthy, the medullary end degenerated; and that "this disorganization could be traced for a short distance in the fibres of the posterior column of the cord, in the ascending direction."* Independently of these fibres, which are at once, or after a short course, lost in the gray substance, the posterior roots send others which pass through the columns for a much greater distance, and which are demonstrated in the case of compression of the cauda equina, which we have borrowed from M. Cornil. In this case, there was an ascending degeneration of the whole length of the posterior columns, and the alteration, very pronounced in the lumbar enlargement, gradually diminished in intensity so as to terminate in a narrow band, spread out under the meninges at the superior portion of the posterior pyramids. There are then some fibres which pass from the posterior roots of the lower part of the cord along the posterior columns, and are lost from point to point in the gray substance, some of them terminating only at the floor of the fourth ventricle. These fibres represent only a small part of those which the posterior roots bring to the cord; the remainder pass at once into the gray substance without aiding in the formation of the posterior columns. This fact is plainly established by microscopic anatomy and by physiology, but could not have been deduced from the study of secondary degenerations.

The ascending radical fibres which we have just pointed out, do not by themselves alone constitute the posterior columns. In fact, in this case of ascending degeneration from compression of the posterior roots, a

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*A. Waller, Nouvelle méthode anatomique pour l'investigation du système nerveux: Bonn, 1852. Appendice: 8e conclusion.

section of the cord made at the lumbar enlargement, at a point where it had not yet received any healthy posterior root, showed, upon the section of the posterior column, quite a large number of tubes, disseminated through the midst of the sclerosed mass, which had taken the place of the radical fibres. These new tubes did not come from the roots; they did not have their nutritive cell at their superior extremity, since we know that compressions of the cord do not determine a descending degeneration in the posterior columns: we must then admit that they had their origin in the gray substance of the inferior part of the cord. The same may be said of other ascending fibres originating at different levels of the cord. We can demonstrate this proposition by comparing the form of the ascending degeneration in cases of compression of the roots, and in that of compression of the cord itself. When the degeneration is consecutive to a lesion of the roots, it is mapped out on the sections by a part of an ellipse, the convexity of the curve being in front; and, its two extremities resting on the posterior aspect of the cord, the tissue external to this line is perfectly healthy. When there is compression of the cord itself, these ascending radical fibres are injured at one point of their course and degenerate above the seat of compression; but the figure which the degeneration presents, upon sections of the cord, is no longer the same. In place of a segment of an ellipse, we have a triangle, the base of which is on the posterior face of the cord and the apex towards the commissure. This is because the degeneration also implicates other fibres which have their nutritive centre at their inferior extremity in the gray substance of the cord. These are the medullary fibres proper, like those which we have pointed out in the antero-lateral columns. In a case of compression of the cord above the lumbar enlargement, I have seen the degeneration pass on retaining its same triangular form as far as the superior extremity of the posterior pyramids; the medullary fibres proper of the posterior columns therefore terminate in the gray substance after an ascending course of variable length. Some of them extend from the lumbar enlargement as far as the floor of the fourth ventricle. They have their origin and their termination in the gray substance; they therefore deserve the name of the posterior commissural fibres.

Ascending radical fibres and posterior commissural fibres are intimately mingled in the posterior columns without producing any confusion in their reciprocal distribution, since the form of the degeneration differs through the whole length of the cord, according as it implicates the former or the latter.

In the two cases of degeneration from compression of the roots or from lesion of the cord, the degenerated part, as it nears the bulb, becomes more and more limited to the posterior and internal portion of the posterior columns. We may therefore conclude that all the fibres of the posterior columns tend towards the posterior and internal portion of these columns, and are there located after they have run the greater part of their course. Then they probably curve forward and outward so as to terminate in the gray substance.

The distribution which I have just indicated is only exact for the fibres which come from the lower half of the cord. Of these fibres those which are prolonged as far as the superior part of the cervical region, are all situated in the substance of the small fasciculi and of the posterior pyramids. The fibres which originate in the upper half of the cord do not appear to mingle with the preceding, so that the sensor nerves of the lower limb and those of the upper limb should remain isolated from one another, separated by the intermediate posterior furrows. Indeed, in a case of compression of the cord at the upper part of the dorsal region, L. Türck has seen the degeneration occupy the external portion of the posterior columns. Unfortunately, he did not make sections through the substance of the bulb nor that of the pons, so that the anatomo-pathological demonstration of the continuation of a part of the posterior columns through the restiform bodies, is completely wanting.

To recapitulate, the posterior columns are formed from fibres which come directly from the posterior roots, from commissural fibres, and probably also, at the upper part, from fibres which, following the lateral portions, reach the brain by the restiform bodies where they form relations with the ascending fibres of the lateral columns.

As a conclusion from all that precedes, we state, exclusively upon a basis of pathological anatomy, that we may consider the cord as essentially constituted by a gray axis, the different parts of which can doubtless communicate with each other even in the gray substance itself, but whose relations are also established through its whole length by commissural fibres, some anterior and others posterior. This gray axis should receive at its anterior part, and throughout its whole extent, fibres which come directly from the brain, it should receive at its posterior part and throughout its whole length, fibres which come from the ganglia of the posterior roots; these latter fibres being of two classes, some, direct, plunge immediately into the gray substance, the others ascending, only get there after a longer or shorter course. Then from the gray axis two classes of fibres should be given off; some should proceed towards the brain along the posterior part of the lateral columns, and perhaps also along the external part of the posterior columns; the others should leave the cord at a point very near their origin, and should go to the periphery along the anterior roots.

Thus considered, the cord may be represented as formed of intrinsic parts, the gray axis and the anterior and posterior commissural fibres, and extrinsic parts, some afferent and others efferent. The extrinsic afferent parts should have two origins, one encephalic and the other peripheral. The extrinsic afferent parts, of encephalic origin, should only exist in the antero-lateral columns, and should establish relations of each of these columns with the two cerebral hemispheres; with the hemisphere of the same side by the direct or internal encephalic fasciculus, and with the hemisphere of the opposite side by the decussating or external encephalic fasciculus. The extrinsic afferent parts of peripheral origin should come from the spinal ganglia by the posterior roots, and should divide into two series of fibres, some plunging directly into the gray axis, the others also arriving at the gray substance after having assisted in the formation of the posterior columns. The extrinsic efferent parts should also have two destinations: some should pass up to the encephalic destination by the antero-lateral column, so as to reach the cerebellum; others, arising probably from the upper half of the gray axis, should reach the pons by the external part of the posterior columns. The others with a peripheral destination should emerge at once from the cord by the anterior roots so as to terminate in the muscles.

Thus the cord would form a necessary intermedial organ for all impressions which reach the brain from the periphery, and for all impulses which go to the periphery from the brain; no fibre would go directly from the brain to the muscles, or from the tegumentary surface to the brain.

This structure of the cord, based entirely upon pathological anatomy, is in perfect harmony with a large number of facts already established by the scalpel and by the microscope, and affords them complete confirmation; or rather, this harmony testifies in favor of the excellence of the method we have pursued.

The results at which we have arrived determine certain questions which were as yet doubtful; besides they seem to us to establish several new facts.

What we have said about the incomplete decussation of the pyramids has been known for a long time, and it was known in what parts of the antero-lateral column the fibres, which come from the pyramids, were located; but the terminations of these fibres were not so precisely determined.

The commissural fibres of the antero-lateral columns had already been admitted by Todd and Schrœder Vander Kolk; however we do not think that their distinction into two classes, according to their length and the special location of each of them, had been pointed out.

Notwithstanding the works of L. Türck, already published for some time, only very vague ideas were held about the ascending fibres of the lateral columns.

In conformity with the first opinion given by Schrœder Vander Kolk, we have shown that certain fibres of the posterior roots assist a great deal in the formation of the posterior columns; but we think that M. Dean has exaggerated their importance in considering the posterior columns as exclusively formed by these roots. We have, in fact, proved that there are in these columns a large number of commissural fibres admitted by Todd, by Gratiolet, and by several other anatomists.

As regards the fibres which pass from the cord to the brain along the posterior columns, pathological anatomy has not yet given us sufficient information; however, we may say that, up to this day, other methods of investigation have not led to a greater degree of certainty: we are as yet reduced to physiological deductions.

SYMPTOMATOLOGY.

The clinical study of the secondary degenerations of the spinal cord has not yet been undertaken; and we may say that it was impossible to study them, when we only knew the first period of these alterations. When a nerve is destroyed at one point of its course, in such a manner as to suppress the relations of the centre with the periphery, the function of this nerve is abolished, and if it still possesses some activity of its own, it cannot display it by any manifestation either of sensation or of movement. We understand, from this, that the substance of the injured elements may become disintegrated without there being any new symptom in the paralyzed parts. We may then state, *a priori*, that the work of degeneration which is going on in a column of the cord does not actually betray itself by any symptomatic modification. Clinical observation fully justifies this presumption. In fact, while the lateral column of the paralyzed side commences to show manifest signs of degeneration by the sixth day, following the commencement of the apoplectic attack, we do not see the symptoms present any notable changes at that period; the primary contraction which is very rare in cerebral softening, and uncommon in hemorrhage, is usually earlier, and is observed from the commencement of the symptoms, or during the first few days. In every case, this symptom, which may exceptionally appear at the period when the secondary degeneration is produced, finds its explanation in the cerebral lesions which we may, with good reason, consider as complications, and it should not be referred to the deuteropathic alteration of the spinal cord.

It is not the same for the contraction which comes on at a later period, a symptom almost necessarily consecutive to old cerebral lesions, and to which attention does not seem to us to have been sufficiently attracted. This contraction of the paralyzed parts which we almost invariably find in cases of hemiplegia of long duration, seems to us to have been wrongly referred to a chronic irritation of the brain, due to a contraction of the cicatrice of the primary seat of disease, or to the progressive march of an imaginary encephalitis. The cause of this permanent, tardy contraction seems to us to be in the cord. Certainly we cannot refer it to the granulo-fatty alteration of the tubes, an alteration which, as we have said above, cannot reveal itself by any symptom; besides, at the time when this contraction commences, the tubes injured in the brain are already destroyed throughout their whole extent. But the tubes of encephalic origin are mingled in the cord with other tubes which arise from the gray substance of the cord itself. These medullary tubes proper are then plunged into the midst of a tissue which, after a considerable period from the commencement of apopleptic symptoms, is the seat of quite an abundant proliferation of connective tissue. It is to the irritation of the medullary tubes by this neoplastic formation, it is to this secondary sclerosis, that we think we should refer the later contraction in cases of hemiplegia.

If this hypothesis is correct, we should meet with analogous symptoms in all those diseases, whatever be their nature and their location, which are accompanied by descending degeneration, with secondary production of connective tissue in the lateral columns; and these symptoms should closely resemble those produced by primary sclerosis of these columns. We are thus led to seek what are, in these different pathological conditions, the common symptoms which can be referred to this common cause, primary or secondary sclerosis of the lateral columns.

It is principally in the modifications which supervene on the part of the motor apparatus that we shall find these symptoms common to the different diseases which are accompanied by secondary degeneration of the spinal cord. We must understand that these researches are not free from difficulties, not only on account of the complication of facts, which hinders their interpretation, but especially because much obscurity still reigns upon this point of the symptomatology of paralyses.

Of all the modifications which the condition of the muscles may present in cases of hemiplegia, the contraction is without contradiction the most important; it is also the one which has principally attracted the attention of observers. Early or tardy, temporary or permanent, it has always been regarded as an index of an irritation going on in the nervous centres. In accordance with Lallemand and MM. Cruveilhier, Bouilland, Andral, Durand, Fardel, Todd has especially insisted upon the semiological importance of this symptom, and has made it the basis of a division of cases of hemiplegia. He admits three classes of them, according to the conditions of the muscles. In the first, the paralyzed limbs remain flaccid and relaxed; in the second there is early rigidity of these muscles, and the rigidity makes its appearance at the very moment of the apoplectic attack, or a short time after. Finally, in the third category, the majority of hemiplegic cases enter, in which the paralyzed muscles, flaccid at the commencement, are attacked at a later period, and progressively, by a rigidity which becomes permanent.

This distinction which Todd has established and so strongly insisted upon, between the early rigidity and the tardy contraction is no less important in a pathogenetic than in a clinical point of view. "If the paralysis had been accompanied by rigidity, says the English author,* I should have been led to the conclusion that the cerebral lesion was of an irritating nature. This rigid state of the paralyzed limb (when it comes on at the same time as, or very soon after, the paralysis) is generally seen when some superficial part is affected, as the meninges or the surface of the brain, or when there is a growth from the skull, or a tumor in the hemispheres, or in some cases of inflammatory softening, or in some conditions keeping up a constant irritation; but when there is a simple rupture of the fibres of a deep-seated part of the brain, as the corpus striatum, with or without pressure, there is no irritation, and the paralyzed muscles are quite lax." And in another place:† "In the majority of cases the early rigidity is due to an apoplectic clot. My idea as to its cause is, that it depends upon a state of irritation, propagated from the torn brain to the point of implantation of the nerves of the affected muscles. But, you will ask, why is it that in some cases of clot, the hemiplegia will be accompanied with complete relaxation of muscles, while in other cases the rigidity of which I have spoken exists? The answer to this question is as follows: In the cases where there is no rigidity, the clot lies in the midst of softened brain, and has not in any degree encroached upon sound brain; but when rigidity exists, the clot has extended beyond the bounds of the white softening, and has torn up, to a greater or less extent, sound brain. * * * This form of hemiplegia sometimes occurs in surgical practice, in consequence of a blow on the head, with depression of bone, or from considerable hemorrhage within the cranium, such as results from injury of the middle meningeal artery, or one or more of its branches. The paralysis of the opposite side is then accompanied by rigidity. * * * Sometimes inflammation of the pia mater, or arachnoid, causes an accumulation of fluid in the sub-arachnoid spaces, and then there is paralysis and rigidity. * * * An affection of the brain, of an irritating character, may give rise to this form of hemiplegia." All these assertions of Todd are based upon observations where autopsies were made; it is with justice that he states the encephalic seat and the irritating nature of the cause of early contractions in certain hemiplegias. Besides, this opinion does not materially differ from that of French pathologists. For a long time we have considered contractions in hemiplegia as a sign of encephalitis; and, besides this too absolute belief, a certain number of facts, several of which have been long known, have led us to admit that the hemorrhage determines immediate contractions, when the seat of disease, breaking up the convolutions, reaches the meninges, or when it bursts into the cavity of the ventricles. Then, is it not to an inflammation which is developed about the seat of disease, that we should refer the muscular rigidity which comes on a few days after the apoplectic attack?

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* Clinical lectures on paralysis, certain diseases of the brain, and other affections of the nervous system, by Robert Bentley Todd: lec. v. p. 100; London, 1856.

† R. B. Todd Lectures, 10 and 11 passim.

According to this opinion, which nothing now seems to contradict, the muscular rigidity would result either from the irritation of the peripheral end of the fibres lacerated by the traumatic cause, or by the hemorrhage, or by the softening, or else from the irritation of the fibres which surround the primary seat of disease, and which have preserved their integrity. According to the first hypothesis, as the lacerated fibres are destroyed after the sixth day, they should rapidly cease to be the seat of any phenomena of excitation. It would then be to these temporary contractions of the commencement that we could apply the opinion of M. Gubler* concerning the part of atrophic softening in the cessation of phenomena of excitation, and in particular of rigidity.

If we may, strictly, consider secondary degenerations as capable of putting an end to the muscular rigidity of the commencement, they play an entirely different part with reference to the later contractions; not, I repeat, that we can consider the contraction as the symptomatic expression of the work of granulo-fatty destruction of the tubes of the cord, nor even that we can attribute to the granules resulting from this destruction the power of irritating the neighboring tubes. The muscles remain flaccid and inert while this process of atrophy is going on; they only become rigid at a later period, when the hypergenesis of nucleated elements commences to appear in the degenerated column.

The later contractions of paralyzed muscles in cases of hemiplegia, are surely those whose clinical history is most imperfect; not that they have escaped notice, but their varieties, the date of their commencement, and the deformities (often characteristic) which they produce, have as yet been only very incompletely pointed out. These contractions are, however, very frequent, and we may say that they are the rule in cases of hemiplegia of long duration. Out of thirty-two cases, the analyses of which will be given further on, I only once found the flaccid hemiplegia. I do not propose to trace out a complete study of these contractions: I will only endeavor to point out the most marked features of their history, taking as a basis the numerous facts which the clinique of the Salpêtrière can furnish.

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* Du Ramollissement cérébral atrophique (Archesis gén. de méd., 1859.) M. Gubler thus expresses the seventh conclusion of his Memoir: Clinical observation has as yet taught us nothing of the particular symptoms of secondary atrophic softenings; but we can forsee that after them we will observe a cessation of the phenomena of excitation, such as contraction, provided that the long duration of the primary affection has not given rise to such changes in the condition of the muscles as are opposed to the mobility of the parts.

When we examine a patient suffering from an old hemiplegia, we usually see the forearm of the paralyzed side is semi-flexed upon the arm, and we are assured that this position is invariably maintained against the influence of gravity by the tension of the muscles of the anterior part of the arm. The biceps in particular, even in cases of very long duration where it has undergone a notable atrophy, makes a more or less marked prominence, and it is evident to the touch that it is stretched like a cord between its insertions. If we tell the patient to extend the arm, he succeeds with great difficulty, even in those cases where voluntary motion is not entirely lost, in increasing by a few degrees the angle formed by the arm and the forearm, and then he is usually obliged to perform this movement mechanically, by pulling upon the paralyzed hand with the member of the healthy side. If the observer himself tries to produce this movement of extension at the elbow joint, he finds a variable resistance, which in some cases cannot be overcome. Usually, however, he succeeds in extending the forearm, at least within certain limits, and he experiences during this movement the same sensations as when the limbs of a dead body in the state of rigidity are made to move. The old cases of hemiplegia, in which the articulations of the paralyzed arm are movable and loose, like those of a corpse when the rigidity has been overcome, are entirely exceptional. It is to these latter that we give the name of flaccid hemiplegias. We will regard all others as rigid, whatever may be the degree of resistance produced by the muscles, and whatever may be the number of muscles affected.

In hemiplegias of long duration, it is very rare to find all the muscles of one half the body paralyzed; it is equally rare to find voluntary motion injured to the same degree in all the affected muscles; it is also exceptional to find all the paralyzed muscles rigid. The contraction in cases of hemiplegia is never general; but it does not affect indifferently such and such a muscle, or such and such a group of muscles; on the contrary it presents a certain regularity in its determination.

I do not know that it has ever been observed in the muscles of the trunk, and it may be said to be limited to the muscles of the extremities. However, there is perhaps an exception to be made for the muscles of the face. Certain facts have led me to think that the muscles of the face, paralyzed at the time of the apoplectic attack, may afterwards undergo retraction, and produce a deviation of the features of the side of the face opposite to that where the deviation primarily existed. There are the cases in which the observations made at the commencement of the affection indicated a facial paralysis on the same side as the hemiplegia, with deviation of the features of the healthy side, and where, upon examining the patients some years later, I found that the features were, on the contrary, retracted on the same side as the paralysis, thus simulating an alternate paralysis.* As for the muscles of the orbit and neck, the contraction of which so often turns the face and the eyes toward the side of the diseased hemisphere at the moment of the attack, we do not see that they are ever affected with a permanent contraction at a later period.*

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* See Bouchard, Aphasie sans lésion de la troisième circonvolution frontale gauche, dans comptes-rendus de la Société de biologie,

Thus limited to the extremities, the muscular rigidity is not observed in the same degree in the superior and in the inferior.

It is always less marked and more limited in the pelvic than in the thoracic extremities; it may be absent in the former, while it exists to a more or less marked extent in the latter, while the reverse is not true.

Out of 31 cases of hemiplegia with rigidity, the contraction affected the muscles of the upper extremity 31 times, and the muscles of the lower extremity only 14 times. Even in the thoracic extremity, the rigidity is not always observed in all the muscles; and those which are rigid are not always so to the same extent. Thus we rarely see the shoulder elevated—10 times in 31 cases—and when it droops, which is more common—15 times in 31 cases—this result is due rather to the force of gravity than to muscular traction. We do not usually find any great difficulty in giving to the arm those different movements which the articulation of the shoulder permits; but, abduction is often quite limited. In its habitual attitude, the arm of hemiplegics is nearly always in a state of adduction, which the action of gravity is often sufficient to explain. Rarely, indeed, the arm is so strongly pressed against the thorax that

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p. 111, année 1864. In this observation, there was no lesion of the pons capable of explaining the alternate hemiplegia, but there was a very pronounced secondary degeneration.

* M. Vulpian has insisted upon this symptom, which M. Cruveilhier had already noticed, and M. Prevost has made it the subject of an interesting memoir: De la Déviation conjuguée de la face et des yeux dans les hémiplégies. (Gazette hebdom., 1865.)

it may be necessary to attribute it to the contraction of the pectoralis magnus; however, this latter cause, though very evident in some cases, should usually be associated to a certain extent with the action of gravity; for, besides abduction being impeded, the humerus is frequently—18 times out of 31—in a more or less pronounced state of rotation inward.*

While the muscles of the regions of which I have just mentioned are contracted in only a slight degree, or even not at all, the muscles of the arm, of the forearm and of the hand, are always completely or partially contracted, and, in every case, it is in those parts that the tardy rigidity is the most pronounced.

The contracted muscles, triumphing over those which are only paralyzed, produce special and permanent attitudes of the limbs; but those remarkable deformities which we find in old cases of hemiplegia, result not only from the predominant action of the paralyzed and contracted muscles over those which are attacked by flaccid paralysis; more frequently, indeed, the deformities are the result of the contraction of antagonistic groups of muscles. This is easily demonstrated for the muscles of the arm and forearm.

The joints which the contraction has placed in a fixed position communicate to the observer a notable resistance, whatever be the direction in which he tries to move them. The elbow, for example, which is usually semi-flexed in cases of hemiplegia, is sometimes as difficult to put in a condition of complete flexion as in that of extension.

Often, however, the forearm presents in both directions a very limited degree of mobility, compatible with some very restricted voluntary or communicated movements; but if we try to increase the movement, we suddenly experience the resistance which I have mentioned above. These movements which we endeavor to produce are alike painful in flexion and extension. Finally we can determine by the touch that the antagonistic muscles are equally contracted. While the biceps is stretched like a cord, we feel the triceps hard and rigid.

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* We shall see that, out of 31 cases of rigid hemiplegia, I have 12 times seen the arm in adduction, once in abduction, and 19 times in an indifferent position.

We might suppose that this contraction of antagonistic groups of muscles was only a spasm, a reflex convulsion provoked by the pain induced by the motions which we give to the paralyzed limbs, something similar to the muscular retractions in arthritis or arthralgia. But in these cases the inhalation of chloroform suddenly puts an end to the spasm and restores their entire freedom of motion to the joints; while I have convinced myself, with M. Charcot, that this is not the case with rigid hemiplegias. Several patients having been put under the influence of chloroform, we have seen that while all the other muscles became relaxed, the contracted muscles preserved a marked rigidity, to a less degree, however, than when the patients were not under anæsthetic influence, but sufficient to prevent complete extension or flexion, and to reduce to their primary position the limbs whose attitudes had been modified. If we continued the action of chloroform for a longer time, we then saw one of the antagonistic groups yield a little to the more powerful traction of the opposing muscles, and produce a slight change in the position of the articulation; then this change once produced remained, even after the patient came out from under the influence of the anæsthetic, and the limb gradually returned to its former position, but not until several hours after the cessation of the inhalations.

The permanent vicious attitudes in hemiplegias of long duration are then for the most part the result of the opposing action of antagonistic groups of muscles contracted in a relatively greater or less degree. Hence it is that the position of the limb is generally intermediate between those which would be produced by the isolated action of these groups of muscles, more or less flexed or more or less extended, according as the contraction is stronger in the flexors or extensors. This fact is made evident by a symptom which we can produce at will in certain hemiplegics, and particularly in those having a unilateral atrophy of the brain resulting from an affection of that organ, dating back from infancy. The usual attitude of these patients consists in a flexion of the forearm with pronation and flexion of the hand and fingers. If by force we extend the fingers, we see that at a certain point they come spontaneously and suddenly as the movement of a spring into a condition of forced extension, at the same time that the flexion increases in the radio-corpal articulation, and the limb remains in this new posture for an indefinite period. If we then induce flexion, we at first experience a certain amount of resistance, then suddenly again the flexion of the fingers is spontaneously completed, and the hand is slightly straightened; thus the primitive attitude is reproduced. Out of 14 patients in the service of M. Delasiauve, suffering from cerebral atrophy, I have observed this symptom twice, and I have found it once with M. Charcot in one of his patients who had cerebral softening dating back thirteen years.

The vicious attitudes produced by permanent contraction in hemiplegics are very variable; they are principally remarkable in the upper extremity. If we consult the table in which are noted the 31 cases of rigid hemiplegia upon which this description is based, we see, as I have said above, that the shoulder is elevated 15 times, lowered 10 times, in an indifferent position 6 times; that the arm is adducted 12 times, abducted once, in an indifferent position 18 times; that it is rotated inward 18 times, and that 13 times it does not show any tendency to rotation in either direction. We see, besides, that the elbow is flexed 27 times, extended 3 times, in an indifferent position once; that the forearm is pronated 24 times, supinated 7 times; that the hand is flexed 16 times, extended 15 times, in an indifferent position 10 times; finally that the fingers are flexed 28 times, extended 3 times.

The hand being always in a determined position of pronation or of supination, and the fingers being always either permanently flexed or extended, we may arrive at the following conclusion: that of all the muscles of the economy, those of the forearm are most often generally affected with permanent contraction in cases of hemiplegia; hence the precept that we should examine, in cases of softening or hemorrhage of the brain, dating back for some time, whether the movements of rotation which we give to the radius are equally easy in both directions, and whether the fingers can be cŏmpletely straightened or flexed without difficulty.

Many of these partial attitudes which I have just pointed out are habitually grouped together and produce deformities of the whole region, the various elements of which do not appear related to one another according to invariable rules, but in which it is nevertheless possible, amid very numerous exceptions, to recognize certain general types. In order to characterize these types, we should take as a starting point the partial deformities, which are never absent, that is to say the condition of pronation or supination of the forearm, and the state of flexion or extension of the fingers. We may thus artificially create four varieties, which, according to our observations, are distributed in the following manner: out of 31 cases of rigid hemiplegia, we find 22 times pronation with flexion of the fingers, twice pronation with extension of the fingers, 6 times supination with flexion of the fingers, once supination with extension of the fingers. Adding now the condition of extension or of flexion of the articulation of the elbow, we should double the number of these varieties, but clinically we have only been able to find the six following varieties:

Flexion of the elbow, pronation and flexion of the fingers,	18	times.
“ “ “ pronation and exten. of the fingers,	2	“
“ “ “ supination and flexion of the fingers,	6	“
“ “ “ supination and exten. of the fingers,	1	“
Extension of the elbow, pronation and exten. of the fingers,	3	“
Indifferent position of the elbow, pronation and flexion of the fingers, ...	1	“

An examination of this table shows that there is no need of thus multiplying the varieties, and that for the clinique we should recognize one great type, the type of flexion characterized by the simultaneous flexion of the elbow and the fingers, or, in the absence of rigidity in the elbow joint, by the simple flexion of the fingers. We will also place in this type of flexion, the cases in which the fingers being extended the flexion of the elbow is so pronounced, that the angle formed by the arm and the forearm is less than 135 degrees.

Another type much less frequent will be characterized by the complete extension of the elbow, whatever be the condition of the fingers, or by the extension of the fingers, provided that the angle of flexion of the elbow be more than 135 degrees.

By consulting the table in which the angles of flexion of the elbow are indicated, we will see that the type of flexion is observed 26 times, while we only meet with the type of extension 5 times.

The condition of pronation or of supination of the forearm adds two varieties for each of these types: thus clinically, we may admit four forms of deviation of the upper extremity in hemiplegias with tardy contraction, and these forms are observed in the following order of frequency:

Flexion with pronation,	20	times.
" " supination,	6	"
Extension with pronation,	4	"
" " supination,	1	"

We will describe only the first form, which is by far the most frequent. In this form we have seen the shoulder lowered 9 times and elevated 7 times; in four cases only, was the shoulder of the diseased side on the same horizontal line as the other. The arm is usually drawn to the body, either by its weight, or by a slight contraction of the *pectoralis magnus;* it is in this form that we have met the only case of abduction of the arm which we have observed. In the 20 cases in which there was flexion and pronation, we have 11 times seen the hand flexed with the fingers; once the hand flexed while the fingers were extended; once the hand extended while the fingers were flexed; finally, the fingers were flexed 7 times while the hand was in an indifferent position. In the case where the flexion of the elbow was most pronounced, the angle formed by the forearm with the arm was 30 degrees.

In this form of flexion with pronation which we usually meet in hemiplegics, the arm is drawn toward the trunk, and, owing to the rotation of the humerus, the forearm is applied against the body; the hand, usually flexed as well as the fingers, is, according to the degree of flexion of the elbow, pressed against the abdomen or against the thorax, and the parts in contact vary according to the degree of pronation of the forearm. In a first degree, the hand is in contact with the trunk by its palmar surface; in the second degree, by its radial edge; in the third, by its dorsal aspect; in the latter case, the elbow is more or less carried forward.

In the type of extension, we can still find these three degrees of pronation. The third was not shown by any of the patients referred to in the table, but it was very marked in the case of a woman in the service of M. Charcot, who has recently died from an old softening. In this woman, the left forearm was completely extended, the hand flexed at a right angle, and the fingers firmly folded up in the palm. The movement of rotation had carried the hand directly outward, the ulnar edge was in front, the radial behind, and this deformity had been increased by a rotation of the arm which had brought the olecranon directly in front. In the case of this woman, whose medulla oblongata I have shown to the Anatomical Society, the descending degeneration had advanced to an extent which we rarely find: the secondary sclerosis of the cord was visible as far as the inferior extremity of the left lateral column, and I should add that the sclerosis reached the meninges towards the middle of the dorsal region, instead of forming a little band, completely surrounded by healthy white substance. I was then too absolute in stating in a former part of this work, that no fibre of the decussating encephalic fasciculus came in contact with the pia mater. In this woman, besides, the flexion of the fingers was such, that the nails in growing cut the skin of the palmer surface. This occurrence, which is not very rare, and which has already been noticed by Todd,* produces very painful ulcerations which secrete an infectious discharge; great care should therefore be taken of the hands and nails; it is prevented by permanently placing in the palm of the hand a roll of bandage, which is sufficiently held there by the contraction of the fingers.

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*Loc. cit., lecture x.

I should say in conclusion of what has reference to the deformities of the hand, that when the hemiplegia commences, before the complete development of the individual, and above all in infancy, the hand which is usually flexed, instead of showing the flexed joints by sharp angles, presents on the contrary upon its dorsal portion a regularly convex surface which continues without interruption from the forearm to the last phalanges. This peculiar form is doubtless the result of an atrophy of the osseous tissue and of the articular prominences; an atrophy in which the subcutaneous cellular tissue does not participate. This character is sometimes sufficient, in the absence of any history, to distinguish a former softening in the adult from unilateral cerebral atrophy consecutive to some lesion which has destroyed a more or less considerable portion of one hemisphere during infancy.*

I shall pass more rapidly over the tardy contraction of the lower extremity in hemiplegics, and the deformities which are its consequences. I shall only state that out of 32 cases of hemiplegia of long duration I have found muscular rigidity in the pelvic extremity only 14 times; the hip was rigid 10 times, 4 times flexed, 6 times extended. The flexion was 3 times accompanied by abduction; the extension was 4 times accompanied by abduction. The knee was found flexed 10 times;

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* Consult upon this subject a memoir presented by M. Cotard to the Society of Biology in 1865: Note sur quelques cas d'atrophie cérébrale; de l'attitude des membres paralysés dans cette affection.

22 times the limb was in the axis of the thigh without any appreciable rigidity. These 10 cases of flexion of the knee coincided 5 times with extension of the hip, 4 times with flexion and once with relaxation of the coxofemoral articulation. The foot was found rigid and out of its proper position 11 times, 9 times presenting the type of talipes equinus and twice that of talipes talus. Of the 9 cases of talipes equinus, 5 were accompanied by flexion of the knee. The 2 talipes talus coincided with a considerable degree of flexion in the femorotibial articulation.

At what period and in what manner is this tardy contraction developed in hemiplegics?

This is a question which has scarcely been proposed, and which is far from having been decided. Todd, who has distinguished so carefully between the precocious and the tardy rigidity, says that he has met with the latter one year after the apoplectic attack, and he quotes from M. Andral a case where the contraction came on three months after the commencement of the hemiplegia. We may see that in one patient, whose case is referred to in the table, the flexor muscles of the fingers were rigid at the end of four months, but in her case the rigidity had already existed for some time. We have had an opportunity, in the case of this woman, to follow the development of the disease from its commencement, and her case is interesting in more than one respect. She was suddenly attacked at the age of 66 years, with apoplexy with complete loss of consciousness and left hemiplegia, without having presented any prodromic symptoms. The following day the intelligence had entirely returned, the paralyzed muscles were flaccid and there was no fever. The temperature of the rectum varied from morning to evening between 100° and 98.9°. At the end of eight days the fever came on; the temperature went up to 101.1°; there was excitement with delirium, and the paralyzed muscles became rigid. Two days after, the temperature came down to 99.6°; the intelligence was restored and the muscles had become flaccid again. From this time the general symptoms disappeared, but the paralysis remained. Three weeks after the commencement of the illness the fingers were semi-flexed, but could be easily extended: however, forcible extension appeared a little painful. Two months after the attack the flexion of the fingers was more pronounced, and quite a marked resistance was experienced when we tried to extend them, an operation which seemed to produce considerable pain; the forearm was slightly pronated, and resisted slightly any movements of supination which we communicated to it; it presented a very slight amount of flexion; we were able to increase this flexion without hurting the patient, but when we afterwards extended it, we observed that after having easily reduced it to its former position we experienced a sudden resistance, of such a kind that the extension could only be completed by an effort which was painful to the patient. At this time there were no cerebral symptoms and no fever.

In this case we see a precocious contraction connected, as the delirium and fever indicate, with slight symptoms of secondary encephalitis; then we see a contraction become insensibly developed, traces of which we can barely find at the end of three weeks, and which is no longer doubtful at the end of three months. It is this latter contraction, which has since increased while the cerebral functions have returned more and more to their normal condition, that we think should be referred to the sclerosis secondarily developed in the place of the degenerated fibres of the lateral column.

This case also shows that if the muscles of the forearm are the ones usually affected by tardy contraction, it commences likewise in them. This contraction comes on gradually and insensibly; this is the reason why we can hardly ever obtain from the patients information of any value concerning the time of the appearance of this symptom. They know that at first their limb did not offer any resistance to the movements communicated to it, and that at a later period it was fixed in one permanent attitude which could only be altered by a certain degree of force, but the transition between these two conditions has been so gradual that usually it is impossible for them to tell, even approximatively, the time of the commencement of the contraction. The determination of this time is almost as difficult for the physician who is watching the development of the disease; so that he had better not give the result of his observations except after quite long intervals, the changes undergone by the muscles from day to day being entirely inappreciable. In the preceding case, the contraction was evident at the end of two months, but it already existed before this time, and I may state that, having inquired into this question of a certain number of patients, I think I may conclude from their replies that while the limb was flaccid during the first month, it already presented a vicious attitude during the third month. It would then appear that the permanent contraction habitually commences in the course of the second month. It is plain that new investigations are necessary to determine this point, as yet obscure, in the symptomatology of hemiplegias.

The contraction commences in the muscles of the forearm; generally the fingers are flexed and the forearm is pronated; then, in most cases, the elbow becomes flexed, and, while the fingers curve more and more, the flexion of the elbow progressively increases in such a manner, that for a long time the attitude of the limb is changed, showing it more every day.

I have remarked that in the patient of whom I have just spoken the straightening of the contracted parts was painful from the commencement, even when a slight effort sufficed to overcome the resistance of the muscles, and then these explorations resulted in momentarily increasing the rigidity. On the contrary, when the contraction is final, the muscles which we extend by force oppose during a considerable time the movements which we communicate to the limbs.

Sometimes, upon lifting the contracted arm of a hemiplegic by the end of the fingers, we see the entire limb agitated by a rapid trembling similar to that which we produce by the same proceeding in the inferior extremities of patients suffering from compression of the cord. I have only met with this symptom in the thoracic extremity in hemiplegia, and I think that we may consider it as an exception.

When the contraction has reached its complete development, it may notwithstanding present momentary variations in its intensity under the influence of certain circumstances, such as emotions or pains along the course of the nerves of the limb; in young women having hemiplegia, we sometimes see the contraction increase during the menstrual period.

I have already spoken of the action of chloroform upon contracted muscles; I shall also say some words of electricity. The induced currents which usually produce in the flaccid muscles of hemiplegias of short duration, slighter contractions than in the normal condition, produce on the contrary a marked and sometimes an exaggerated effect upon the muscles affected with permanent rigidity, even when they have undergone a certain amount of atrophy. But when this atrophy affects unequally the different muscles of a limb, we can see, as I have found in one case, that by applying the poles to the muscles which act against the deviation, this deviation, far from diminishing, on the contrary increases. In this case, no doubt, the currents traverse the atrophied muscles and influence their antagonists so as to increase their already predominant power.

Once established, the tardy contraction may last for long years, often during the whole life of the individual, but sometimes it seems to diminish. Then however, the muscles cannot undergo a sufficient amount of extension, and the articulations present certain alterations which hinder any complete straightening, and the vicious attitudes remain; they are then passive. One might also ask whether we can hope for a cure of the hemiplegia when the muscles are already affected by tardy contraction. I do not know any fact which can encourage this hope, and the patients sometimes are deluded with reference to this subject.

Voluntary motion is not always totally abolished in the paralyzed limbs of hemiplegics, but the contraction limits and renders more difficult the muscular actions which are still under the influence of the will. If the rigidity diminishes, then these movements recover more liberty, and such a patient who is always to remain impotent imagines that he sees in this modification the commencement of his cure.

Some symptoms which have a very great analogy to these which we have just studied are observed in certain diseases of the cord which are accompanied by secondary sclerosis of the lateral columns, and especially in cases of compression of that organ. During the first period which correspond to the granulo-fatty degeneration of the tubes, the paralyzed muscles remain flaccid;

then, at a more or less advanced period, the contraction appears, the muscles atrophy and the lower limbs assume permanent attitudes which it is difficult to overcome. In some cases, however, the muscles remain flaccid and the limbs are swollen with an elephantiasic œdema; this is on account of the softening of the inferior portion of the cord. The phenomena of excitability, on the contrary, are observed in those cases where the autopsy reveals a secondary descending sclerosis. I need not insist in detail upon these symptoms, which have been very well described, especially by MM. Louis, Cruveilhier, and Brown-Séquard,* nor upon the characters of the contraction, for it is in every respect identical with that of patients suffering from hemiplegia. I think that, in order to explain these facts, it is not necessary to consider that there is an accumulation of nervous influx in the inferior part of the cord; we have here an irritation of this inferior extremity, as M. Brown-Séquard thinks; but this irritation has its anatomical cause.

A woman in the wards of M. Charcot, suffering from an ulcerated cancer of the breast, the commencement of which dated back for six years, was suddenly seized with violent, lancinating pains in the lower extremities; for two months, however, the patient had enough strength to be able to walk with the assistance of a cane. At the end of this time, she became unable to stand and was obliged to keep her bed; her legs were flaccid and inert. About seventy days after the time when she became bedridden, her limbs commenced to become flexed, and this flexion, slightly pronounced at first, progressively increased. The legs were strongly flexed upon the thighs, the thighs were in a state of adduction with a certain amount of flexion. A considerable amount of resistance was experienced when we endeavored to extend the contracted limbs, and these attempts were very painful to the patient. The sensibility was preserved; there was a certain degree of hyperæsthesia and some pains in the lumbar regions, with a very painful feeling of constriction around the abdomen and at the base of the lungs. Although purulent during the last few days of life the urine remained acid until death. The patient died the eighteenth of January, 1866, about six months after the commencement of the paralytic symptoms. The autopsy showed that the cord was compressed by a cancerous tumor of the first dorsal vertebra and by a purulent effusion in the canal, extending from the seventh cervical to the tenth dorsal vertebra. Independently of the ascending degeneration, in the cervical region, we found throughout the whole substance of the lateral columns of the lumbar enlargement, a considerable number of myelocytes and embryoplastic nuclei. The muscles of the posterior portion of the thigh showed no transverse striæ, either by direct or oblique light; the primitive fibres were studded with numerous fatty granules, (resisting the action of acetic acid;) the nuclei of the sarcolemma were extremely numerous.

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* Louis, Recherches d'Anatomie Patholog. Cruveilheir, Anatomie Patholog. du corps humain. Brown-Séquard, Lectures on the diagnosis and treatment of the principal forms of paralysis of the lower extremities: London, 1861.

In this case also, the contraction commenced about two months after the début of the paralysis, precisely at the period when the proliferation of connective tissue becomes developed in the secondarily degenerated columns. In another case of compression of the cord, by Pott's disease, which I examined at the hospital Sainte-Eugénie, with M. Triboulet, death having taken place one month and a half after the commencement of the paralysis, I noticed that the muscles were flaccid all the time, and at the autopsy I found only a fatty degeneration of the lateral columns below the seat of the lesion without any hypergenesis of the elements of connective tissue.

We see that the permanent contraction which is common to hemiplegias and to compressions of the cord, presents in both cases the greatest analogy as regards symptomatology; it is connected with an anatomical condition of the cord common to both these affections, and does not become developed in either case until the time when the secondary sclerosis of the lateral columns commences. I should add that the permanent contraction of the extremities is seen to have the same characters in primary sclerosis of the lateral columns, as is shown by a remarkable case communicated by M. Charcot* to the Medical Society of the hospitals, as well as in certain cases of diffused sclerosis of the cord, affecting in a greater or less degree these same lateral columns, examples of which are to be found in a recent work presented by M. Vulpian,† to the same society. Why then, since in all these cases we observe common symptoms and common lesions, do we refer the contraction, in paraplegias, to the lesion of the cord; in hemiplegias, to a lesion of the brain?

This cerebral origin of the tardy contraction is not proved; it was admitted at a time when we were ignorant of the secondary alterations of the cord, and when we considered softening as a chronic encephalitis. It is based therefore upon a double error.

If we admit that the tardy contraction in hemiplegia results from a secondary sclerosis of the lateral columns, we shall have a reason for certain facts which would otherwise appear inexplicable. Thus, in compressions of the cord, the contraction of the inferior extremities is stronger than in hemiplegias, because in the hemiplegia the secondary sclerosis is only developed in the situation of one portion of the decussating encephalic fasciculus, while in the compression of the cord it occupies not only this entire fasciculus, but a certain number of long commissural fibres besides. Thus, also, in hemiplegias, the superior extremity is most often contracted, and is so to a greater degree than the lower extremity, because the decussating encephalic fasciculus is richer in nervous fibres in the cervical region than in the lumbar region, where it terminates in a point; the sclerosis, which is substituted for this fasciculus throughout its whole length, will therefore be more developed at the level of the origin of the nerves of the arm than at the point of departure of the nerves of the pelvic extremity. Thus, also, may we not say that if the thoracic extremity is strongly contracted, while the head is not perceptibly deviated, that it is because the rotator muscles of the head are partly supplied with nerves from the spinal accessory which arises from the lateral portions of the bulb and from the superior extremity of the cord at points which are not influenced by the secondary sclerosis, since, in this region, it is limited to the internal part of the anterior pyramids? But it might be objected that all hemiplegias are not accompanied by contraction. We can answer this objection by stating that there are certain cerebral lesions, as for example superficial lesions of the convolutions, which are capable of producing hemiplegia, and which do not determine secondary degeneration.

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* Hystérie avec contracture sclérose des cordes latéraux, 1864.

† Note sur les scléroses en plaque de la moelle épiniére, 1866.

We might refer the tardy contraction to other causes, such as an alteration in the structure of the muscles due to the prolonged inertia, but we find complete hemiplegias which always remain flaccid; or to an atrophy of the muscles, resulting either from rest or from some other cause, but the contraction is found in 9 out of 31 cases, without there having been any atrophy of the muscles, and in one case I have found a certain amount of atrophy of the muscles of the arm, without any contraction. There are in reality alterations in the structure of contracted muscles coinciding with a fawn-colored appearance of their tissue; the transverse striæ are often less marked than usual, sometimes absent, the substance of the primitive fasciculi is more or less granular, studded with fatty and pigmentary granules; the nuclei of the sarcolemma increase in number; 16 times out of 30 the size of the muscles diminishes.* If these alterations are the proximate cause of the contraction, of which we have no proof, nothing authorizes us to consider them as developed without the action of the central nervous system.†

Independently of the contractions, one quite important symptom seems to me to be attributable to descending degenerations, and more especially to the secondary sclerosis of the bulb. I refer to the epileptiform attacks and to those which are evidently epileptic, which we often meet with in subjects attacked with hemiplegia during infancy, and which are not infrequent in old persons suffering from softening, and in which we find at the autopsy considerable atrophy of a peduncle, of the pons and of the bulb. I must confess that this hypothesis does not as yet appear to me susceptible of a rigorous demonstration; but it seems to me to be true, because in one patient suffering from an intense sclerosis of the bulb from compression of that organ, the epileptic fits were very strong and very frequent, and because when we saw him sometimes, a few moments previous to an attack, the contraction markedly increased in the paralyzed limb.

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* Out of 30 cases of hemiplegia with contraction, I have 5 times observed an increase in size of the paralyzed limb, but this hypertrophy no doubt depended upon the œdema of the subcutaneous tissue rather than upon an alteration of the muscles.

† M. Charcot has called my attention to a very curious peculiarity of paralyzed and contracted muscles in hemiplegias of long duration: this is the absence of post mortem rigidity. At the autopsy the limbs of the healthy side present a perfect rigidity; on the contrâry the muscles which were contracted during life are entirely flaccid. However, numerous examinations made at different hours after death have shown that usually the diseased muscles do not escape the post mortem rigidity, which is manifest in them almost immediately after death, and only for a very short time. The absence of cadaveric rigidity is seen also in infantile paralysis. It would be curious to find out whether putrefaction is developed more rapidly in the paralyzed limbs.

We very often see in cases of hemiplegia an increase in the size of the nerves, with vascularity and increased thickness of the envelope of connective tissue, often also with a deposit of fatty globules in its interstices. I do not know whether this kind of hypertrophous neuritis, to which M. Charcot, and after him M. Cornil,* have called attention, depends upon secondary degeneration of the cord, or whether it is not solely the result of inertia; at all events, it seems to be connected with those pains, often quite severe, already pointed out by Remak, which the hemiplegics feel in the paralyzed arm, pains which are increased by pressure along the course of the nerve, and which are often alleviated by the application of a blister, as M. Charcot has several times proved.

As for the alterations of nutrition, such as the atrophy of the compact tissue of bone, the squamous condition of the skin, &c., I doubt whether they can be referred to the secondary degeneration of the cord.* This degeneration, besides, does not modify in any respect the phenomena of calorification which we observe on the side of the paralyzed limbs. The paralyzed hand is always the warmer, even at a time very distant from the commencement of the symptoms, and we sometimes find considerable variations in the temperature of the two sides of the body.†

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* Note sur les lesions des nerfs et des muscles liées à la contracture tardive et permanente des membres dans les hémiplegies. (Comptes-rendus de la Société de Biologie, 1863.)

The examination of five patients, made with this object in view, has furnished me with the following results:

Age.	Date of commencement.	Paralyzed hand.	Healthy hand.
70 years.	Several years.	95.3°	89.6°
42 "	14 months.	95°	89.9°
72 "	12 years.	99.3°	98.6°
65 "	5 "	97.8°	97.5°
51 "	14 months.	97.1°	95°

Thus far I have only spoken of the symptoms of descending degeneration; the secondary ascending scleroses do not appear to betray themselves by a single symptom. We might however imagine that this sclerosis of the posterior columns could determine the phenomena of motor ataxy in the upper extremities, but it is not so; and this is explained by the separation which the intermediate posterior sulcus establishes between the centripetal fibres of the pelvic and those of the thoracic extremities. Even in cases of compression of the cord in the cervical region, when the secondary sclerosis also affects the external fasciculus of the posterior column, it is probable that we should not find symptoms of ataxy. In fact, ataxy supposes the destruction of a certain number of nerve tubes, and secondary sclerosis does not appear to destroy the healthy tubes which are plunged into its interior; it only deforms them and may exalt their activity, but does not annihilate them.

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* As for the articular alterations, which are of frequent occurrence, they depend evidently only upon the immobility, and differ in no respect from those which are produced by that cause, outside of any influence of the nervous system. Upon this subject consult Teissier, Memoires sur les effets de l'immobilité longtemps prolongée des articulations. Lyons, 1844.

† According to M. Routier, there should be a dimunition of the temperature of the paralyzed side immediately after the attack. The elevation of the temperature only comes on at the end of twelve or twenty-four hours. (A. Routier, Théses. Paris, 1846.)

In conclusion, I will state that these cases which I have gathered at Sainte-Eugénie, with M. Triboulet, and two others which I have studied at the Salpétrière with M. Charcot, warrant me in affirming that a cure is possible, even when the columns of the cord seem to have undergone secondary degeneration. In these five cases there was complete paraplegia due to the compression of the cord by Pott's disease. In four cases, sensibility and motion have returned in all their integrity; in only one, motion, without having recovered its entire liberty, nevertheless allows the patient to walk. In this case the paraplegia was flaccid; in the others it was accompanied with contraction. We may therefore conclude that the nerve tubes of the cord may be regenerated like those of the peripheral nerves, not only in the child but also in the adult, and even when the degenerated fasciculi have already been the seat of a hypergenesis of nuclear elements.

SECONDARY DEGENERATIONS OF THE SPINAL CORD.

EXPLANATION OF THE PLATE.

FIG. 1. Secondary degeneration of the mesocephale in an old softening of the right hemisphere. Atrophy and gray color of the right peduncle. Flattening of the Pons Varolii on the right side. Atrophy and gray color of the right anterior pyramid. Gray discoloration in the left lateral column below the bulb.

FIG. 2. Histological lesions in the first stage of secondary degenerations.

a. Granular bodies.

b. Vessel with fatty granulations accumulated in the lymphatic sheath.

c. The same granulations, but more numerous, in the lymphatic sheath at the point of bifurcation.

FIG. 3. Histological lesions in the later stages of secondary degenerations.

a. Myelocyte.

b. Vessel with numerous nuclei and very few fatty granulations in the sheath.

c. Amyloid body.

FIG. 4. Section of the cord in the dorsal region in a case of old secondary degeneration of the posterior columns.

ac and *a'c.* The posterior columns.

bc and *b'c.* The portion of these columns where the tubes are scanty, separated by the connective tissue of new formation.

FIG. 5. Sections of the cord in a case of old lesion of the left hemisphere. The parts colored black indicate the points of location of the secondary degeneration.

a. Cervical enlargement.

b. Dorsal region.

c. Lumbar enlargement.

FIG. 6. Descending degeneration in a case of compression of the cord at the upper part of the dorsal region.

a. Section made a few centimeters below the compression.
b. Inferior portion of the dorsal region.
c. Lumbar enlargement.

Fig. 7. Ascending degeneration in a case of compression of the cord at the lower part of the dorsal region.

a. Section made a few centimeters below the compression.
b. Superior portion of the dorsal region.
c. Middle of the cervical enlargement.
d. Superior portion of the cervical enlargement.

Fig. 8. Secondary degeneration in a case of compression of the cauda equina.

a. Inferior portion of the lumbar enlargement.
b. Superior portion of the lumbar enlargement.
c. Middle of the dorsal region.
d. Middle of cervical enlargement.

AGE.	DURATION.
66	4 m
69	3 yr
50	18 m
59	6 m
70	2 yr
44	5 yr
67	9 m
56	1 yr
67	3 yr
33	13 y
70	sev.
42	14 m
56	18 y
75	12 y
66	5 y
51	14 m
79	18 m
76	10 y
40	1 y
68	sev.
67	2 y
69	1 y
74	10 y
66	3 y
68	1 y
77	sev.
72	2
67	3
61	3
65	8
76	2
74	2

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Archives générales de médecine N.° de Septembre 1866, page 300.

Fig. 1.

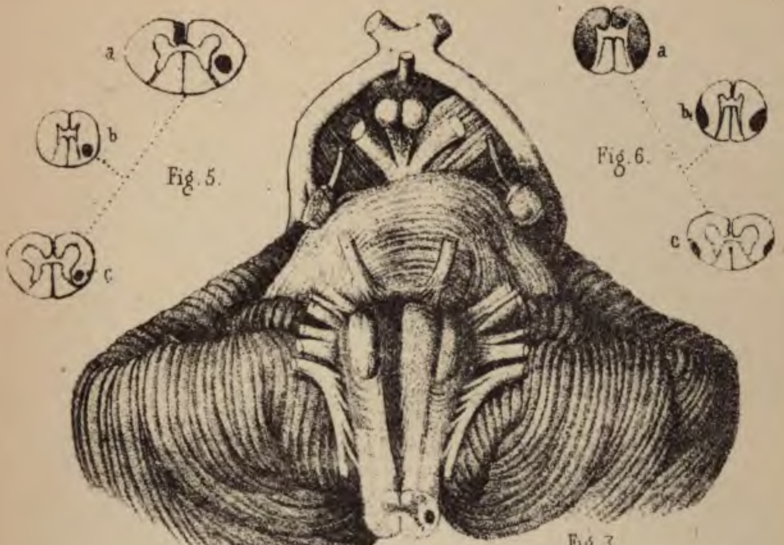


Fig. 5.

Fig. 6.

Fig. 2

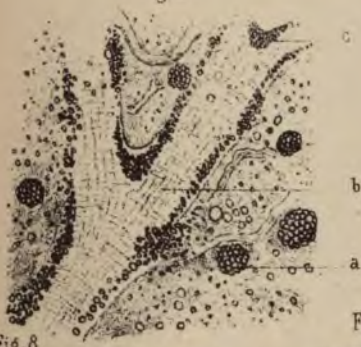


Fig. 3

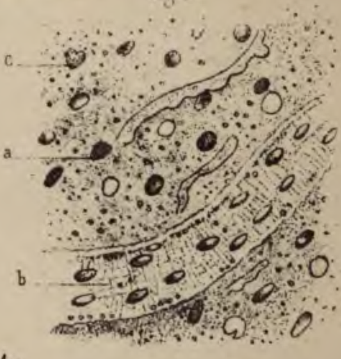


Fig. 8.

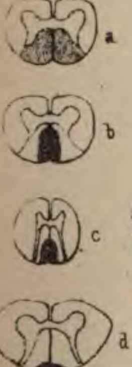


Fig. 4.

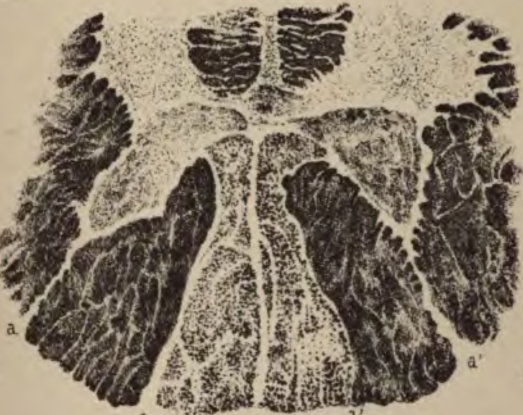
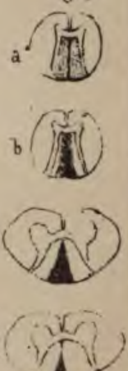


Fig. 7.



Leon Tripier del. Imp. Becquet, Paris. P. Lackerbauer lith.

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5

THE PULSE OF THE INSANE.

THE PULSE OF THE INSANE.

BY EDWARD R. HUN, M. D.,
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[From the AMERICAN JOURNAL OF INSANITY, for January, 1870.]

Before examining the results of investigations made upon the pulse of the insane, it might be well to consider the physiological pulse as traced by the sphygmograph, and also to determine some of the changes which it undergoes in consequence of morbid conditions not attended by psychical phenomena.

The normal pulse trace as obtained by the sphygmograph of Marey, consists of an upright or vertical line terminating in a moderately sharp point, and followed by a gradual line of descent, which latter line is broken into waves or undulations at two points. Such a trace is represented in figure 1, and in consequence of its having three apices it is termed *tricrotic*.

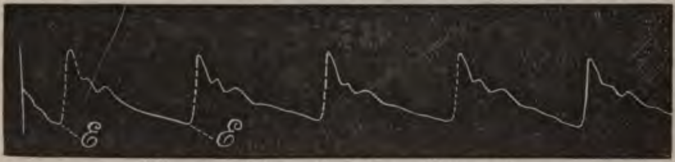


Fig. 1. Normal pulse. Tricrotic.

If we discard the various forms of cardiac disease as foreign to this paper, we may state that the most frequent and interesting of the many metamorphoses which the pulse undergoes, are these which accompany febrile action, and one of the most important of these is an increased rapidity. As the temperature of the body rises, the pulse becomes more frequent, and at the same time assumes a different form.

In order to explain this change we will find it convenient to give a name to the various portions of the trace, and therefore we call the apex formed by the upper extremity of the line of ascent, in the normal type, and the commencement of the line of descent, the great or primary wave and the two undulations which interrupt the line of descent, the first and second secondary waves respectively.

Now as the pulse becomes more frequent we find the first secondary wave diminishing in size, and at a temperature of about 104°, when the pulse varies between 100 and 120 per minute there remain only two apices to each pulse curve, the first secondary wave having entirely disappeared, and in place of the *tricrotic* or normal pulse we have the *dicrotic* or characteristic fever pulse.

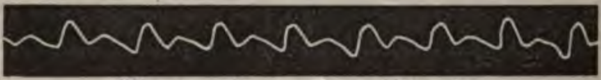


Fig. 2. Fever pulse. Dicrotic.

As the temperature and rate of the pulse increases we have yet another modification of the pulse curve. The second secondary wave diminishes and finally disappears at a temperature of 106° and a pulse of 140 per minute, and the result is such a trace as is represented in figure 3, where both secondary waves have disappeared, and only a single apex is observed. This pulse is termed *monocrotic*. Between these marked metamorphoses we find intermediate types where the pulse trace is termed *sub-dicrotic*, (fig. 4,) and *super-dicrotic*, (fig. 5.)

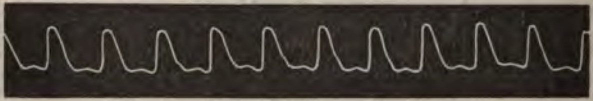


Fig. 3. Fever pulse. Monocrotic.

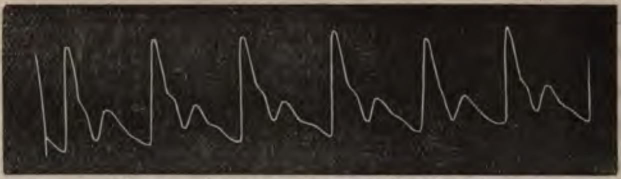


Fig. 4. Fever pulse. Sub-dicrotic.

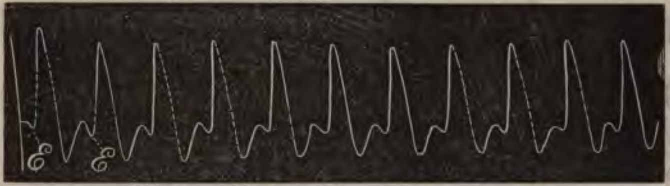


Fig. 5. Fever pulse. Super-dicrotic.

The principal modifications of the pulse curve therefore consist in a deviation from the *tricrotic* to the *dicrotic* or *monocrotic* type in ordinary forms of disease, and such deviation from the normal standard is accompanied by an increase not only in the rate of the pulse but also in the temperature of the body. Hence, there exists a certain harmony between the temperature and the rapidity and form of the pulse. This harmony holds good in cases of depression as well as of exaltation of temperature, for in cases of algidity such as are sometimes found during convalescence from acute fevers, where the temperature falls below the normal standard, the rate of the pulse is diminished and at the same time the sphygmographic curve becomes more decidedly tricrotic than in health.

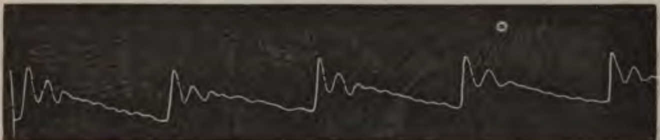


Fig. 6. Algid pulse.

It has been found by Wolff, and is so stated by him, that "when this harmony between the temperature and the pulse is so interfered with that an elevation or depression of temperature is not accompanied by a corresponding alteration of the pulse curve, we have a disease or a period of a disease in which the central nervous apparatus is implicated to an unusually great and dangerous extent. Thus we find in febrile diseases of the nervous system a loss of parallelism between the temperature and the pulse, as is often manifested by the rate of the latter."

The same author finds, and my own investigations fully confirm his statements, that in the insane this loss of parallelism between the pulse and temperature is destroyed, and furthermore, that the form of the pulse curve is fundamentally altered. The trace no longer presents a series of acute apices, as in the normal or febrile pulse, but each curve is surmounted by a horizontal line or flat top, and assumes the form described by Marey as the senile pulse.

Before entering more minutely into the study of the pulse trace of the insane, I may with propriety mention, that in persons who suffer from psychical derangement, the bodily temperature differs but little if any from the normal standard, except in cases where there is some intercurrent disease, and as a general rule an elevation of temperature above 100° indicates the existence of some complicating disease which does not directly depend upon the insanity. The temperature of intercurrent febrile diseases in the insane runs the same course as in the same diseases in the sane, and under these circumstances the pulse undergoes such modifications that in some instances an insane patient who has when apparently in good physical health presented a pathological pulse trace, may under the influence of febrile reaction produce a curve which closely resembles the normal *tricrotic* pulse of the sane.

The pathological pulse of the insane always tends toward the *dicrotic* or *monocrotic* type, being never *tricrotic* in uncomplicated cases. It becomes more characteristic as the mental condition degenerates, and assumes its typical form in the most profound state of dementia. The following traces which I obtained from patients in this Asylum, will serve to demonstrate the pulse curves so found in the different forms of insanity.

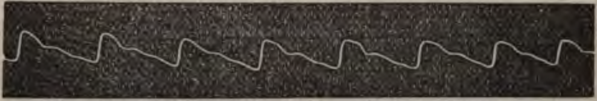
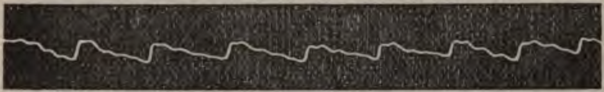


Fig. 6. Melancholia. Female, aged 38 years.


Fig, 7. Melancholia. Female, aged 28 years.

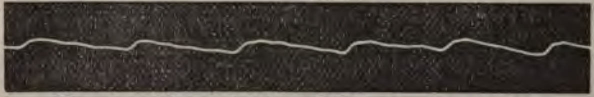


Fig. 8. Melancholia. Male, aged 48 years.

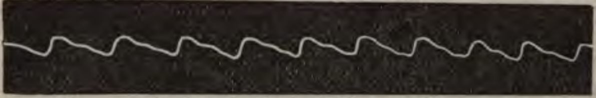


Fig. 9. Melancholia. Male, aged 51 years.

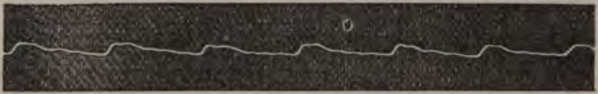


Fig. 10. Acute mania. Male, aged 40 years.

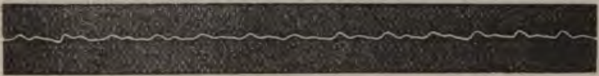


Fig. 11. Acute mania. Male, aged 28 years.

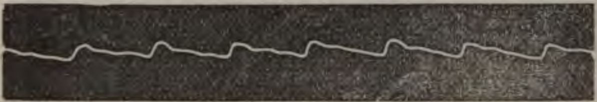


Fig. 12. Sub-acute mania. Male, aged 26 years.

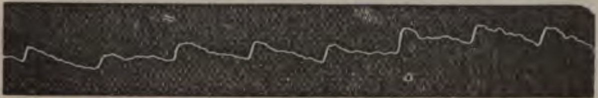


Fig. 13. Paroxysmal mania. Female, aged 30 years. Subsequently died of apoplexy.

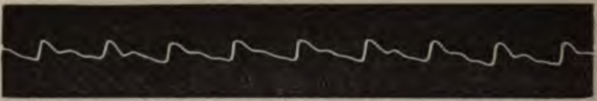


Fig. 14. Periodic mania. Male, aged 51 years. Taken while he was recovering from an attack.

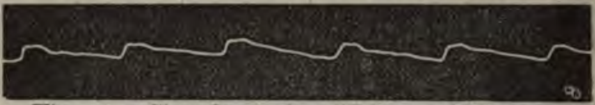


Fig. 15. Chronic mania. Male, aged 36 years.

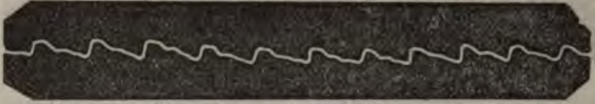


Fig. 16. Chronic mania. Male, aged 60 years.

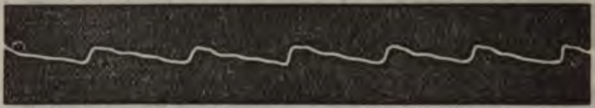


Fig. 17. Chronic mania. Male, aged 38 years.

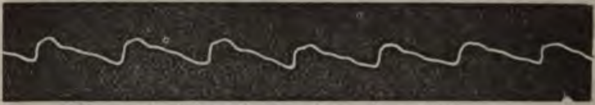


Fig. 18. Chronic mania. Aged 78 years.

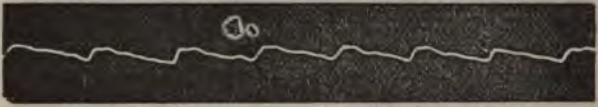


Fig. 19. Chronic mania. Aged 50 years.

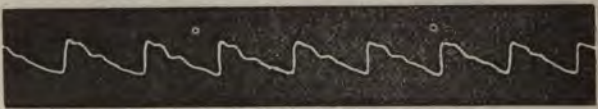


Fig. 20. Dementia. Aged 18 years.

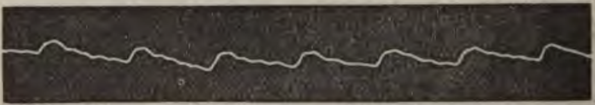


Fig. 21. Dementia. Aged 45 years.

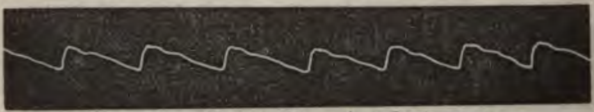


Fig. 22. Dementia. Aged 37 years.

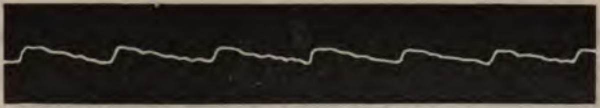


Fig. 23. Dementia. Aged 34 years.

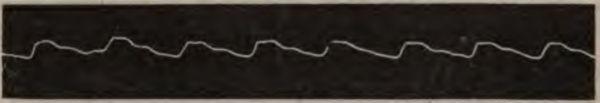


Fig. 24. Dementia. Aged 40 years.

An analysis of the above traces shows two points of difference between them and the normal type: 1st, a loss of *tricrotism* with a marked tendency to the *dicrotic* and *monocrotic* form, and 2d, a flat top in place of the acute angle found in health and febrile diseases. The first of these changes we have already found to exist in cases of fever when the temperature of the body is elevated, but among the insane there is no increase of temperature, and we may therefore consider a dicrotic pulse unaccompanied by an abnormal rise of temperature as one of the physical phenomena of insanity.

The second deviation from the normal standard is still more characteristic of psychical disorder. This peculiar pulse curve with a flat summit has been described by Marey, and attributed by him to a pathological condition of the arterial walls, whereby their elasticity was diminished and an impediment offered to the free flow of blood. Now in the examples of this form of pulse which he figures in his work upon the circulation of the blood, Marey states that his patients were inmates of the Bicêtre and Salpêtrière, which asylums contain for the most part insane, demented and paralytic persons. Consequently, we are as fully justified in considering the alteration of the pulse curve due to the condition of the nervous system, as we are in attributing it to a pathological state of the walls of the arteries.

Moreover, I am fortunately able to furnish pulse traces of two patients who have fallen under my observation, in which Marey's results are directly contradicted.

Fig. 25, represents the pulse of a patient aged 60 years, who presented upon physical examination all the characteristic symptoms of structural change in the heart and arteries. Angina pectoris, dyspnœa, and a condition of the radial arteries which communicated to the finger, a sensation as if they were firm, inelastic cords, were symptoms which I frequently had occasion to observe, and yet the trace has an acute apex, and is distinctly *tricrotic.*

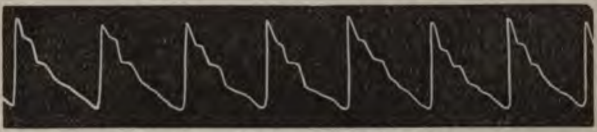


Fig. 25. Male, aged 60 years.

Fig. 26, on the other hand, is the pulse of a patient who was hemiplegic, and presented symptoms of mental derangement resulting from an apoplectic attack, and in whom neither auscultation or palpation revealed any abnormal condition of the heart or arteries, and yet we find a flat-topped monocrotic pulse curve.*

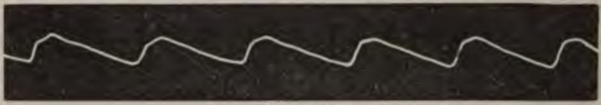


Fig. 26.

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* Note.—I do not intend to be understood as denying that an atheromatous condition of the arteries may not be accompanied by a pulse which gives a trace similar to that seen in fig. 26, but I think that in these cases the same defective nutrition which causes the change in the walls of the blood-vessels may also interfere with the proper reparation of nerve tissue, and thus influence the form of the pulse. In fact, a diseased condition of the nutrient vessels of the brain is one of the most frequently observed facts in cases of paralysis and mental disorders, and it may be that the alteration

If we examine the traces represented in figs. 12, 15, 17 and 22, we find the well marked senile pulse of Marey, while the age of the patient contraindicates atheromatous degeneration, and we are therefore compelled to seek some other explanation of the phenomenon, the key to which, I think, can only be found in the sympathetic nervous system.

The disordered condition of the ganglionic system in the insane, is evidenced by such marked symptoms that it would be indeed surprising if we did not find a pathological condition of the pulse. The sluggish circulation through the peripheral capillaries is rendered evident by the passive congestion of the hands and feet, and the white line bordering the edge of the lip, observed both in melancholia and mania, and attains its maximum when the patient relapses into the most profound dementia; the frequent attacks of local hyperæmia, which in some cases are sufficiently intense to result in rupture of the vessels, and to produce that remarkable appearance known as *hæmatoma auris*, can only be attributed to the disordered action of the sympathetic system, while the altered condition of all the secretions, both cutaneous and intestinal, must be referred to the same agency. Again, the defective nutrition of the insane is but the index of some unknown cause, influencing the functions of organic life through the medium of the sympathetic ganglia.

Comparatively recent investigations of physiologists have demonstrated that the centres of the great sympathetic are situated in the *crura cerebri*, and pass downward along the central axis of the cord. From these centres fibres radiate toward the periphery of the body

of the nervous tissue is due to the disease of the vessels, and that the pathological pulse is therefore the result of the combination of two elements, which are related to one another as cause and effect.

in close contact with the fibres of the cranial and cerebrospinal nerves, which they accompany for a short distance, and then branch off to supply the walls of the blood vessels, over which it is their special functions to preside. Other fibres again pass into the gray matter of the hemispheres, and are intimately connected with the nerve cells occupying the cerebral convolutions. Hence, it results that the sympathetic nerves may be influenced not only by external agents acting upon their peripheral extremities, but also by emotional causes influencing their centripetal prolongations. In fact the experiences of daily life continually offer examples of this mode of irritation, the emotions of fear, anger and shame all give rise to external phenomena with which we are familiar, as pallor of the countenance, blushing, &c., &c.

In insanity, when the cerebral activity is far greater than in health, and where a constant flow of the most dissimilar ideas passes through the mind in rapid succession, each in turn calling forth some emotional excitement, the sympathetic centres are subject to continual excitation, and by reflex action manifestly influence the phenomena of the circulation. This centripetal irritation, when continued for a certain time, wears out the excitability of the ganglia, and results in a paralysis of the nerve filaments supplying the circulatory apparatus, in consequence of which, we find a passive dilatation of the smaller arteries and capillaries, with a loss of the normal elasticity of their walls. The free flow of blood from the arterial to the venous system is interfered with, and the result is a sluggish, monocrotic form of pulse. It is not unlikely that cardiographic tracings of the action of the heart itself would show a deviation from the normal rythm, so that the insane pulse may depend not only upon the abnormal condition of the vessels, but also in some degree upon functional disturbance of the cardiac contractions.

In conclusion, I will give a few traces borrowed from Wolff, which corroborate the opinion expressed above with regard to the action of emotional excitement upon the form and rythm of the pulse.

Figure 27, represents the pulse of a patient having chronic mania during a condition of bodily and mental repose, while figure 28 shows the modification of the pulse curve caused by the patient's having a strong desire to ask a question.

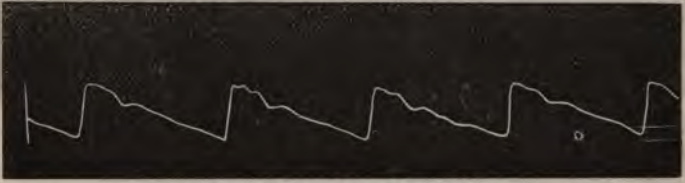

Fig. 27. Chronic Mania.

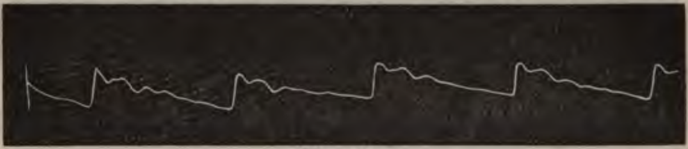

Fig. 28.

Figure 29, is the pulse of a patient who exhibited slight symptoms of mania, and who presented the pulse trace shown in figure 30, under the influence of excite-

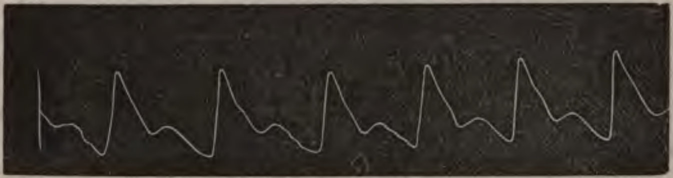

Fig. 29. Mania.

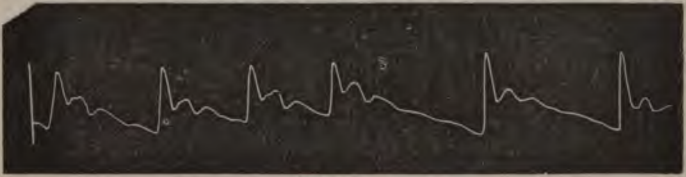

Fig. 30.

ment caused by a desire to complain of bad treatment. As he became still more angry his pulse assumed the form represented in figure 31, and finally being no longer

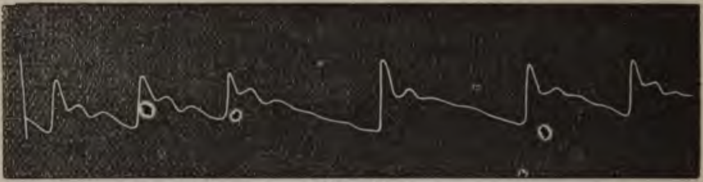

Fig. 31.

able to restrain himself, he broke out in a storm of words, and gave the trace figured in figure 32.

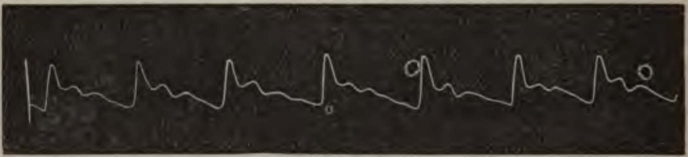

Fig. 32.

In the last case we find that emotional excitement not only influences the form of the pulse, changing it from the *dicrotic* to the *tricrotic* type, but it also modifies the cardiac rythm, and produces a kind of intermittence, which continues during the effort to restrain the feelings, and resumes its regular rate as soon as the patient finds relief in an outburst of passion.

From the above, I am of the opinion that in the earliest stage of insanity, when the mental agitation is most acute, we should expect to find a pulse nearly approaching the normal tricrotic type, and in proportion as the excitement diminishes and the patient falls into a state of mental apathy and dementia, the pulse becomes *dicrotic*, and at last *monocrotic*, sluggish and flat-topped, as a result of the loss of irritability or paralysis of the great sympathetic system.

HÆMATOMA AURIS.

BY E. R. HUN, M. D.

[From the *American Journal of Insanity* for July, 1870.

Hæmatoma Auris, or sanguineous tumor of the external ear, has been for a long time observed as a frequent concomitant of insanity; and various authors have discussed the questions relative to the true nature of this phenomenon, both as regards its pathology and its relation to those conditions of the nervous system which accompany mental derangement. M. Ferrus, in France, and Bird, in Germany, called attention to it in 1838, since which time it has been studied by MM. Belhomme, Lunier, Renaudin, and others, and in 1848, Dr. Franz Fisher, physician to the Illenau Asylum, published quite a lengthy article upon the subject.

Since my connection with the New York State Lunatic Asylum, I have had frequent opportunities to see cases of hæmatoma, and I propose in this paper to present the subject under consideration from a clinical point of view, and deduce my conclusions from original observations, and from the history of such cases as I have been able to find recorded in the books of the Asylum. In a few cases which I have seen and examined during life, opportunities have been presented for post mortem examination, and upon these examinations I base my opinion as regards the pathology of the disease.

Before giving an account of individual cases, it may not be out of place to describe briefly the general appearance and progress of hæmatoma.

Preceding the appearance of the tumor we find that one, or in rare cases both, of the ears become red and swollen, while at the same time the face and eyes give evidence of a strong determination of blood toward the head; occasionally, however, the redness is absent, and the skin maintains its normal color, while the tumefaction appears due to a slightly œdematous condition of the auricle. This condition of the part is preceded by no manifestation of constitutional disturbance, as chills, &c., and the patient appears in his usual health.

In the course of a period of time varying from a few hours to several days, an effusion of blood takes place, and the malady attains its full development. The tumor occupies the auricle of the ear, and projects from its concave surface. In size it varies from a bean to a hen's egg, and in the latter case obliterates all the ridges and depressions observed in the normal ear, and presents a smooth rounded surface. It is usually hard and unyielding, but upon careful examination is found to present a feeling of fluctuation, and in some cases, especially those of long standing, affords a sense of distant crepitation to the finger of the examiner, which is supposed to be due to the breaking up of clots. In certain cases it is fluctuating in the centre, and is indurated about its circumference. The skin is distended and smooth, while its color assumes a purple hue. The lower part or lobe of the ear alone remains unchanged.

The tumor may remain for a longer or shorter time in *statu quo*, after which it may either undergo spontaneous rupture, or may be gradually absorbed. If rupture takes place, or if the tumor be punctured, there is a large escape of clotted blood mingled with sanguinolent serum, and by the introduction of a probe we may satisfy ourselves of the existence of a very considerable cavity. If let alone, the opening, whether spontaneous or induced by artificial means, has a strong tendency to close, and the cavity refills in the course of a few hours, and the tumor resumes its former magnitude. If, however, the orifice be kept open, a sero-purulent discharge ensues, which continues often for a long time, and may terminate in an exudation of plastic lymph, uniting the walls of the cavity, and causing its obliteration; leaving an indurated mass which subsequently contracts and produces a strange and characteristic deformity.

A certain amount of deformity remains in those cases where absorption takes place without rupture, but it is not nearly so marked as in the former case.

The following cases of hæmatoma are copied from the records of the Asylum, and many of them have fallen under my personal observation at different stages of their progress.

No. 1. · A. H., aged 47 years. General paresis. Admitted May, 1853. The first evidences of hæmatoma auris were discovered October 15. Both ears became red and enlarged rapidly until all the ridges and depressions had disappeared. During the early part of November, both ears ruptured spontaneously, and discharged very freely. After this rupture he had frequent convulsions, and failed rapidly, dying November 13, in violent convulsions. An autopsy was made, and the usual appearances of paresis were found in the brain, but no mention is made of the condition of the ears.

No. 2. H. S. D., aged —— years. Chronic mania.

Third attack. Admitted November, 1854. Had hæmatoma of both ears, which ruptured spontaneously, and subsequently contracted. He was discharged unimproved, and is still living insane in the county almshouse.

No. 3. G. D., aged 50 years. Dementia. Admitted January, 1857. Had hæmatoma of left ear, with rupture and subsequent contraction. Died November, 1858.

No. 4. J. A. C., aged 34 years. General paresis. Admitted January, 1857. Insanity hereditary in his family. Was discharged during a remission of his disease in June, 1858. Re-admitted May, 1859. On July 24, the first evidence of a simple sanguineous cyst in each ear was noticed. Effusion rapidly took place, until the ridges and depression of the ears were entirely obliterated. July 31, tumors fluctuate. Little or no pain, and no modification of mental condition since this complication commenced. Tumefaction of ears not abated, but rather increased. September 30, the tumors of ears have gradually subsided, and left the ears slightly thickened. May 10, 1860, patient died suddenly. No autopsy.

No. 5. A. H., aged 29 years. Acute mania. Admitted September, 1859. Hæmatoma of the left ear was observed November 1, which was gradually absorbed, and disappeared November 22. In January, 1860, he had hæmatoma in both ears, and with it an attack of erysipelas of the head and face, which latter affection subsided, leaving the hæmatoma still existing, which by February 2, had developed to a remarkable degree. February 6, the left ear ruptured and suppurated. February 17, the opening closed, and the ear is swelling again. February 10, he made a violent attack upon another patient, who in defending himself, seized the swollen right ear and ruptured it, causing the escape of a large quantity of coagulated blood. The patient was taken away in October, 1861, in a condition of hopeless dementia.

No. 6. J. H. S., aged 47 years. General paresis. Admitted June, 1860. Had hæmatoma in right ear, July 12. Died October 23, 1860.

No. 7. C. M., aged 40 years. Melancholia. Admitted June, 1864. Hæmatoma commenced in right ear September 29, and increased to an enormous size. It finally ruptured with profuse discharge, after which it became shrunken and contracted. The patient was discharged unimproved December 17, 1869, and sent to the Willard Asylum.

No. 8. I. G., aged 55 years. Dementia. Admitted April, 1867. Hæmatoma of both ears commenced to develope June 29, 1867. Ears increased in size, and ruptured with subsequent contraction. Discharged unimproved March 14, 1868, and sent to county almshouse.

No. 9. D. M., aged —— years. Melancholia. Second attack. Admitted January, 1868. Hæmatoma of left ear commenced May 18, 1869. On July 3, had hæmatoma of both ears. August 1, the left ear burst at upper part of concha, while he was sitting in a chair, and the contents, consisting of fluid and clotted blood, were thrown to the ceiling, a distance of twelve feet, so as to stain the plaster. The right ear still continued to increase in size, and ruptured spontaneously during the latter part of August. Both ears afterwards contracted. Died September 9, 1869. An autopsy was made, and the ears examined. Upon cutting into them, the perichondrium was found much thickened, and separated from the auricular cartilage on its outer aspect, so as to leave a large smooth cavitylined with a smooth shining membrane, and containing a few drops of serous fluid.

No. 10. J. I. L., aged 53 years. Chronic mania. Admitted May, 1868. Had hæmatoma of left ear October 22, 1868, which increased in size until all the ridges and depressions were obliterated, and a rounded tumor as large as half a hen's egg bulged from the ear. It ruptured and became permanently thickened and contracted. Died December, 1868.

No. 11. J. P., aged 37 years. Acute Mania. Admitted May, 1868. Had hæmatoma of left ear in June, which became very large and ruptured, subsequently contracting. During October, 1869, was removed by his wife, contrary to the advice of the physician; the patient being still in a condition of dementia.

No. 12. J. H. K., aged 41 years. Melancholia. Admitted May, 1868. In January, 1870, while on the convalescent ward, developed hæmatoma in the right ear, which did not grow to any great size, and which still continues.

No. 13. A. P. McI., aged 37 years. Melancholia. Admitted July, 1868. Had strong hereditary tendencies to insanity, her father, paternal uncle, and sister being insane. On September 10, she had a swelling in the right ear, resembling hæmatoma. September 14, a swelling appeared in left ear, similar to the one in the right. September 23, the swellings subsided. She left the Asylum July 31, 1869, with still some thickening of both ears. [Note.—From the time of her admission up to March, 1869, she was constantly violent, noisy, and under great mental excitement, after which she became quiet; but even when she left the Asylum she had not regained her former vigor of mind, and will probably return.]

No. 14. S. B. W., aged 37 years. General paresis. Admitted August, 1868. Had hæmatoma of the left ear August 27, which increased in size until September

17, when it was enormous. It then ruptured, and discharged profusely from the concha. During the night a scab formed on the point of rupture, when it at once filled up to its former size, and then the swelling formed over the helix, and extended over the posterior surface of the auricle, and under the scalp. It ruptured a second time, with profuse discharge, and subsequently contracted materially. Died November 24.

No. 15. J. T., aged 38 years. Chronic mania. Admitted August, 1868. During October had hæmatoma of the right ear, which was absorbed without rupture. The patient was removed to the county alms-house, September, 1869, unimproved.

No. 16. G. H., aged 50 years. General paresis. Admitted December, 1868. During April, 1869, hæmatoma of one ear commenced. It increased rapidly in size until April 19th, when it ruptured; 21st, still discharging. May 2d, discharges a little serum. May 10, discharge ceased. Ear much contracted and diminished in size. Died October, 1869.

No. 17. J. R. F., aged 45 years. General paresis. Admitted February, 1869. About two months after admission, he developed hæmatoma of both ears. Neither of them ruptured, but the ears were left permanently thickened. He eloped September, 1869.

No. 18. T. H., aged 37 years. Acute mania. Admitted February, 1869. Had a large hæmatoma of the left ear in October, 1869, which ruptured, and left the ear much contracted. Died January, 1870. Autopsy revealed cerebral and pulmonary disease, and it was found that the perichondrium in both ears was firmly united to the auricular cartilages by a quantity of organized exudative material, which completely obliterated the cavities, which had contained the effused blood, during the existence of hæmatoma.

No. 19. C. J., aged 24 years. General paresis. Admitted March, 1869. About five months after admission had a large hæmatoma of the right ear, which ruptured and discharged, leaving the ear contracted and thickened. Died March, 1870.

No. 20. H. G. E., aged 28 years. Acute mania. Admitted May, 1869. Hæmatoma of right ear commenced September 6, 1869, and attained a considerable size, after which it gradually subsided, leaving some thickening of the ear. The patient is still living in the Asylum, in a profound state of dementia.

No. 21. C. S., aged 32 years. Melancholia. Admitted July, 1869. During August he developed a hæmatoma of the right ear, which gradually increased in size until all the lines were obliterated. While in this condition a violent patient struck him a severe blow upon the left ear with a broom-handle, causing the ear to swell very much, and producing ecchymosis of the surrounding parts, but without producing anything like hæmatoma. The right ear subsequently ruptured spontaneously, and discharged about half an ounce of sero-sanguinolent fluid, after which the organ became much contracted and deformed. The patient still remains in the Asylum, and is considered to be a chronic case.

No. 22. W. McC., aged 45 years. General paresis. Admitted September, 1869. Hæmatoma commenced in the left ear November 1, 1869, and increased in size until November 8, when the right ear began to enlarge. The left ear increased until November 15, when it was enormous. It then ruptured and discharged large quantities of bloody fluid. It was still discharging November 28, and the ear was commencing to contract. The right ear gradually subsided. At the present time, (March, 1870,) the left ear is very small, contracted and deformed, while the right is of nearly normal appearance. The patient is now in the last stage of paresis.

No. 23. A. W., Aged 60. Chronic mania. Admitted December 1, 1869. Has been insane for more than a year. Hæmatoma of the right ear commenced January 12, 1870, and became quite large, but is now subsiding without having ruptured.

No. 24. W. S., aged 37. Melancholia. Admitted December, 1869. Complains of severe pain in the head, and has had many attacks of what he calls the "falling sickness." Is much depressed and emaciated. Refuses food, and is fed with difficulty. Destructive and suicidal. Tried to kill one of the attendants. Has to be restrained in a chair. January 21, hæmatoma commenced in the right ear, and continued to increase until March 27, when it ruptured, and discharged a large amount of bloody matter.

An analysis of the above twenty-four cases would show that hæmatoma occurred twenty-three times in men and only once in women. The form of insanity was general paresis in eight cases; melancholia in six; acute mania in four; chronic mania in four, and dementia in two. Both ears were affected in nine cases; the right ear alone in nine and the left ear alone in five, while in one case the records do not state which ear was diseased. In fifteen cases the cyst ruptured; in seven absorption took place; in one case of double hæmatoma one ear ruptured while the other underwent absorption, and in one case it is not stated whether rupture or absorption occurred. In nine cases the patients died insane at the Asylum, nine were discharged unimproved, and six remain and are in a state of dementia.

We find, therefore, that hæmatoma ia almost entirely confined to the male sex, and that it occurs in those forms of insanity which are incurable, also that in the great majority of cases the cyst undergoes rupture rather than absorption of the effused blood.

Several points of interest present themselves in the study of this peculiar phenomenon, and first of all the pathology of the disease is worthy of consideration. The earlier observers were of opinion that the tumor was caused by the effusion of blood into the subcutaneous connective tissue of the ear, but M. A. Foville called attention to the fact that during the absorption of the tumor the skin did not present the gradually decreasing shades of ecchymosis which is characteristic of all subcutaneous sanguineous collections, and he also pointed out that the skin was separated from the contents of the tumor by a tense resisting membrane. He therefore concluded that the effusion of blood took place between the perichondrium and the auricular cartilage. If we examine the plate accompanying this article, which represents a section of a hæmatomatous ear, which I obtained at the autopsy of case No. 9, we see that the perichondrium is detached from the anterior surface of the cartilage in such a manner as to leave a distinct cavity, which is lined by a smooth surface. This same appearance I have found in all the ears which I have been enabled to examine, when the patient has previously had hæmatoma, except in one case in which the cavity seemed to have been entirely obliterated by the deposit of a layer of organized lymph, which had re-united the perichondrium and cartilage throughout their whole extent. I therefore am of the opinion that the seat of the effusion is between the perichondrium and cartilage, and this opinion is further strengthened by the fact that after the rupture of the cyst, if the orifice be maintained open, a serous, or sero-purulent discharge continues for a long period of time, which discharge must of necessity have its origin in a secreting surface, and could not be produced in a cavity caused by the breaking down of the connective tissue by effused blood. The deformity which results from hæmatoma is easily explained by the adhesions which takes place between the inner surface of the perichondrium and the external surface of the cartilage, when the intervening cavity is emptied of its contents. In these cases, when rupture takes place, the distended and stretched perichondrium applies itself as a flaccid and wrinkled membrane to the surface of the cartilage, and the points upon each surface which formerly corresponded no longer come in contact with each other, an exudation of lymph takes place resulting in adhesion and subsequent contraction, and drawing and distorting the ear into strange but characteristic forms. On the other hand, when gradual absorption takes place the perichondrium contracts as it approaches the cartilage, and when the two surfaces at last come in contact they are evenly applied, so that the contraction which eventually ensues simply lessens the size of the organ, but does not draw it out of shape to any considerable extent. Actual experience proves the above view to be correct, since those cases of hæmatoma which rupture spontaneously, or are opened artificially, do leave far greater deformity than the cases in which the blood is gradually absorbed.

The question as to the cause of the effusion of blood which constitutes the hæmatoma is one which is much discussed, and has been differently answered by different observers.

When we consider the intimate connection between the circulation in the ears and that of the rest of the head, and remember the redness and turgescence of these organs during cerebral congestion, and their pallor during syncope, we cannot but acknowledge that any disturbance in the circulation in the brain is prone to produce a corresponding alteration in the circulation of the ears. Now in all chronic cases of insanity, and especially in general paresis, we find a tendency to repeated congestions of the head, and under such circumstances it is natural to suppose that the blood vessels of the ears become gradually dilated so as to favor the occurrence of an effusion of blood. In fact, in one case published by M. Marcé, in 1858, each of the eye-lids as well as the ear was the seat of a sanguineous effusion, as if all the capillaries of the head and face were rendered turgescent at the same time.

Besides the cerebral congestions we have another strong agent in producing peripheral dilatation of the blood vessels in the sympathetic system, and in a former paper of mine, published in this JOURNAL, upon the "Pulse of the Insane,"* I think I have clearly shown that this result may be produced simply by the centripetal excitation of the sympathetic system by strong emotion. A kind of reflex action is thus set up, which is due to the intimate blending of the fibres of the cerebro-spinal and sympathetic systems in the cranial cavity. A strong emotional excitement acts upon the centripetal fibres of the sympathetic, is reflected to the central ganglia, and reacts upon the fibres governing the peripheral circulation, and in this manner are produced the phenomenon of blushing, pallor, &c., &c. Among the insane the emotions become much stronger from the fact that they are under no control or governing power of the will, and therefore tend to modify to a greater extent the functions of the circulation and nutrition.

We therefore find two powerful idiopathic causes for the production of hæmatoma, viz.: cerebral congestion and centripetal irritation of the sympathetic system by the emotions, and either of these causes I consider to be sufficient to produce the phenomenon.

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* American Journal of Insanity, January, 1870.

Many authors have thought it necessary to attribute hæmatoma to external agencies, such as personal violence, either self-inflicted or received at the hands of others; but if this be so why we do not meet with hæmatoma in persons who are not insane, and who have received some injury of the ear? It is true that a few cases of this kind have been reported, but they are indeed very few, when we consider the exposed situation of the external ear, and its constant liability to injury. Two cases are reported as having occurred in the practice of Langenbeck, but in one the patient was a girl of twelve years of age, and it is especially mentioned that she was very *ignorant* and *wild*, while the second patient labored under an attack of delirium tremens; so that in both of these cases the presumption is that some pathological condition of the nervous centres existed which may be considered as the predisposing cause of the hæmatoma. Toynbee states however that he met with a true case of hæmatoma in a professional boxer who received a blow upon the ear, and who did not present any evidences of insanity; and Rupp states that he has met with this condition of the external ear in soldiers, and other persons not mentally disordered. Two cases which occurred in this Asylum, present points of great interest as regards the production of hæmatoma by external violence. One of them has been already given as case No. 21. The patient, who had melancholia, developed a hæmatoma of the right ear, and when the tumefaction was at its height, he was violently struck on the left ear by a broom-handle, in the hands of another patient. The result was that the disease of the right ear ran its usual course, and finally ruptured, while the left ear became swollen and ecchymotic, but did not in any degree assume the appearance of hæmatoma. Now in this case, the injury was inflicted upon an insane patient who was already predisposed to the disease, and yet failed to produce the phenomenon. The second case was that of a patient laboring under acute mania, who was in a ward with violent lunatics, one of whom struck him a severe blow upon his ear with a boot, so that the whole organ as well as the surrounding parts were swollen and ecchymosed, and yet there was no appearance of hæmatoma.

The two above cases recall to my mind another, when the patient entertained very marked delusions, thinking that he constantly heard voices, in order to prevent which he stuffed his ears with bits of paper, and all kinds of filthy rubbish, and kept his hands continually pressed against his ears, and yet with all this irritation, no evidences of hæmatoma ever presented themselves. The above three cases lead me to believe that external agencies have but little to do with the production of hæmatoma, and that we must seek for the real cause among the pathological lesions connected with insanity itself.

The case cited as No. 12, occurred in a patient, who was at the time quiet and melancholic, and was in the convalescent ward, among patients who were entirely orderly, and when it was impossible for him to receive any injury or violent treatment, and yet a true hæmatoma developed itself.

The local treatment of this affection is a matter of but little if any importance, and I may add of but little avail. Puncturing the sac or laying it open, results in more harm than good. The most favorable termination is gradual absorption of the effusion, since the remaining deformity is much less in these cases than in those where the contents of the cyst are suddenly evacuated by spontaneous rupture or by artificial means. Dr. Gray has, however, given me the details of one case where he observed the patient during the earliest stage of the affection, and where he found the posterior auricular artery pulsating with unusual violence, and apparently much increased in size. It occurred to him at the time to apply a ligature to the vessel, and thus shut off the supply of blood to the ear, and he proposes to do so if a similar case presents itself. Whether such a procedure will be of service can only be determined by experience.

The constitutional treatment of this affection simply resolves itself into the general treatment of insanity itself. That it indicates a diminished power of innervation and nutrition I think admits of no doubt, since we find it as an accompaniment of those forms of mental derangement which are chronic, and associated with enfeebled physical power. A general tonic and supporting form of treatment is indicated, especially where rupture has taken place and is followed by obstinate suppuration.

In conclusion,

1st. Hæmatoma Auris consists in an effusion of blood into the space between the perichondrium and cartilage of the ear.

2d. It occurs as a rule in persons who are insane, and is only very exceptionally found in the sane.

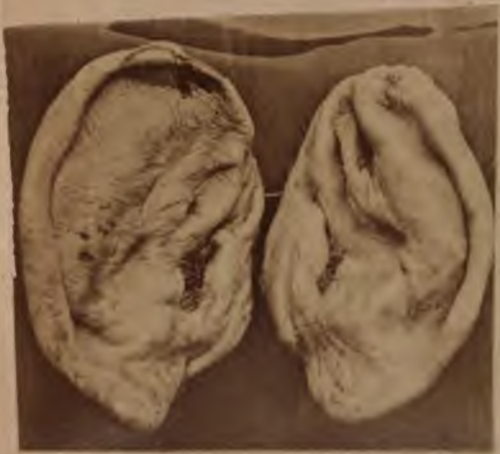
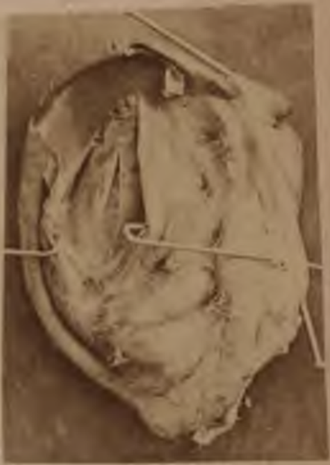
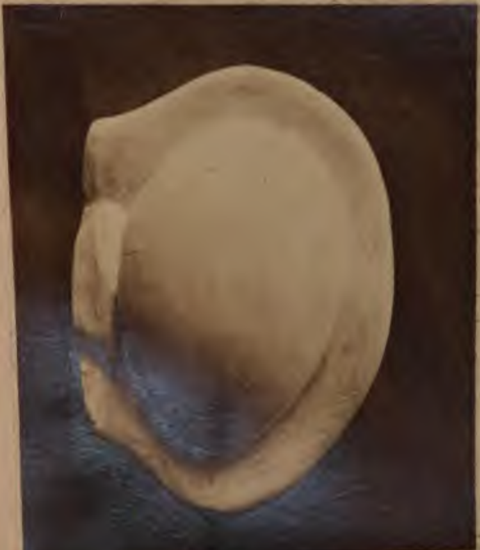
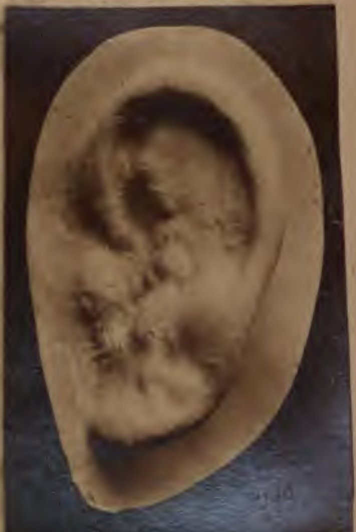
3d. It accompanies those forms of insanity which are essentially chronic or incurable, and consequently its presence indicates a very unfavorable prognosis.

4th. It is idiopathic, depending upon a pathological condition of the brain, and is incapable of being produced by external violence alone.

DESCRIPTION OF PLATE.

The two lower figures represent the ears of the patient described in case No. 4. The left hand figure is a photograph taken from a plaster cast, which cast was made when the tumefaction was greatest. The right hand figure represents the same ear after rupture and contraction had taken place.

The three upper figures were taken from the ears of the patient described in case No. 9. The two left hand figures show the amount of contraction which took place after rupture of the cysts; while the figure on the right shows a section of one of them, and demonstrates the separation of the perichondrium from the auricular cartilage.

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STATUTORY LAW

OF

NEW YORK

REGARDING THE INSANE.

By EDMUND WETMORE, Esq.

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STATUTORY LAW OF NEW YORK REGARDING THE INSANE.*

BY EDMUND WETMORE, ESQ.

I. STATUTORY DISABILITIES OF THE INSANE.

The laws in which the ordinary disabilities of the insane are referred to, are as follows:

1. *Aliening Lands.*—Every person capable of holding lands (except idiots, persons of unsound mind, etc.,) seized, or entitled to any estate or interest in lands, may alien such estate or interest at his pleasure, with the effect and subject to the restrictions and regulations provided by law.

2. *Marriage and Divorce.*—When either one of the parties to a marriage shall be incapable for want of understanding of consenting to a marriage, the marriage shall be void from the time its nullity shall be declared by a court of competent authority.

The Supreme Court may by a sentence of nullity declare void the marriage contract for the cause existing at the time of the marriage that one of the parties was an idiot or lunatic.

3. *Statute of Limitations.*—If a person entitled to commence any action for the recovery of real property, or to make an entry or defence founded on the title to real

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* This abstract of the principal laws of the State of New York respecting the insane, was compiled some years ago, for the simple purpose of facilitating a comparison between the legislation of our own and our sister States upon that subject. The paper was not intended to be a complete digest even of all our statutes, much less an orderly statement of the law of insanity in New York, as far as settled by legislative enactments and judicial decisions: it merely collates the substance of the statutes referred to, for the convenience of any who desire to know their general and most important provisions.

property, or to rents or services out of the same, be, at the time such title shall first descend or accrue, insane, the time during which such disability shall continue shall not be deemed any portion of the time limited for the commencement of such action, or the making of such entry or defence; but such action may be commenced, or entry or defence made, after the period of twenty years, and within ten years after the disability shall cease, or after the death of the person entitled who shall die under such disability; but such action shall not be commenced, or entry or defence made, after that period.

If a person entitled to bring certain enumerated actions other than actions for the recovery of real property, be, at the time the cause of action accrued, insane, the time of such disability is not part of the time limited for the commencement of the action, except that the period within which the action must be brought cannot be extended more than five years by such disability, nor longer than one year after the disability ceases.

4. *Wills.*—(*a.*) *Real Property.*—All except idiots, persons of unsound mind, married women, and infants, may devise their real estate.

(*b.*) *Personal Property.*—Every male of the age of eighteen, and every female not married of the age of sixteen, of sound mind and memory, and no others, may bequeath personal estate.

II. APPOINTMENT OF COMMITTEES FOR THE INSANE.

[The following proceedings will be found treated of at length in "Creary's Special Proceedings," and the present statement of them is taken mainly from that work.]

1. *Courts which have Jurisdiction.*—In this proceeding the old method, in accordance with the ancient practice of chancery, remains substantially unaltered. The general power of chancery has been transferred to the

Supreme Court, which now supercedes the former Court of Chancery in this State. It is enacted that the Supreme Court shall have the care and custody of all idiots, lunatics, and persons of unsound mind, and of their real and personal estates, so that the same shall not be wasted or destroyed; and shall provide for their safe keeping and maintenance, and for the maintenance of their families and the education of their children, out of their personal estates and the rents and profits of their real estates, respectively. It is also enacted that the County Courts shall have the care and custody of the person and estate of a lunatic, or person of unsound mind, residing within the county, and also such courts shall have jurisdiction with respect to the sale, mortgage or other disposition of the real property of such persons situated within the county.

The same authority is also given to the Court of Common Pleas of the city and county of New York, where the lunatic or person of unsound mind resides in that city, or the property is situated therein. And the like authority is also given to the Superior Court of the city of Buffalo, where the lunatic resides in that city, or the property is situated therein.

In the case of a non-resident lunatic, the Supreme Court may appoint a committee to enable the said committee to obtain control of property in this State. And the court may issue a commission to inquire as to the lunacy of a non-resident, but it cannot be executed beyond the limits of the State. In such case the court will direct it to be issued in such county as may be most convenient.

2. *Who may apply for a Commission.*—There is no restriction: a stranger may apply, though the application of relatives will be entertained in preference, if there is no valid objection to them.

3. *Method of Application.*—The application is based upon a petition to the court of proper jurisdiction, which should be accompanied with affidavits, setting forth the unsound condition of mind of the party, and stating some instances of conduct or language which plainly indicate it. Where the lunatic is a non-resident of the State, the petition must also show that he is the owner of property situated in this State.

4. *The Commission.*—Upon the granting of the petition and entering an order to that effect with the clerk of the court, the commission usually prepared by the attorney for the petitioner will issue. It is usually directed to three persons, commanding them to inquire into the alleged insanity, the time when it began, condition of the alleged lunatic's estate, etc.

5. *Notice that the Commission has issued.*—The party proceeded against as a lunatic is entitled to reasonable notice of the time and place of executing the commission, even though a non-resident. A requisition to this effect is usually inserted in the commission. Dangerous madness, or peculiar circumstances, may excuse this notice.

6. *Place of executing the Commission.*—The order usually directs the commission to be executed at or near the place of residence of the alleged lunatic. Non-residence will dispense with, and other circumstances may modify, however, this provision of the order.

7. *Witnesses.*—Subpœnas may be issued by the commissioners, and the court will enforce them.

8. *Precept for a Jury.*—The commissioners may issue a precept to the sheriff of the county in which the commission is to be executed, commanding him to summon a jury.

9. *Duty of the Sheriff.*—The sheriff will summon not less than twelve nor more than twenty-four jurors. It

is also his duty, if required, to attend the execution of the commission, for the purpose of guarding the jury room, etc.

10. *Proceedings before the Commissioners.*—The party proceeded against is entitled to be present and may have counsel. Before proceeding with the examination the commissioners should require proof of the due service of notice of the execution of the commission. The leading commissioner, usually the first one named in the commission, instructs the jury in the duty assigned them, and administers the oath to them and to the witnesses. The party himself may be inspected and examined. The commissioners, or one of them, after the testimony is closed, should submit the question to the jury in the form of a charge, without arguments of counsel on either side. It is necessary that twelve of the jury should concur in the verdict. The verdict being returned,

11. *The Inquisition is made up accordingly, signed and sealed by the Commissioners and by the Jury.*—The inquisition states the finding of the commission whether the party is a lunatic or not, or any other facts concerning which inquiry was to be made, relative to property, etc.

12. *Return of Commission.*—This is done by annexing the inquisition to the commission, duly indorsing them, and filing them with the clerk of the court.

13. *Proceedings on Return.*—Upon the filing of the return, a motion is made to confirm the finding of the jury. The alleged lunatic or his friends may also apply at the same time for an order to set aside the inquisition, or for leave to traverse it, or for an issue.

14. *Who may be appointed Committee.*—There is no particular restriction as to the person who may be appointed committee. The court will exercise its discre-

tion, and consult the interests of the lunatic. The custody of the person is usually committed to some of the nearest kin.

15. *Appointment of Committee.*—The committee is appointed upon application to the court. The same person may be appointed committee both of the person and of the estate, but where the estate is large it is usual to have a separate committee for each. A reference is frequently directed to ascertain the suitable person to be appointed committee.

16. *Bond of Committee.*—This is required before the committee can enter upon their duties, and must have two sufficient sureties and be approved by a judge of the court. Security may sometimes, however, be dispensed with by the court.

17. *Traverse of Inquisition, etc.*—In England the inquisition may be traversed as a matter of right by the alleged lunatic or his friends. In this State they will order a jury trial to decide the fact, in their discretion. Application for jury trial is founded upon petition, notice to the opposite party, and, usually, affidavits. The inquisition may be set aside for irregularity, or upon proof of an erroneous verdict by the jury in the first instance. If the lunatic is restored to his reason, application may be made to the court to supercede or suspend the commission, or the commission may be superceded if it has remained unexecuted several years, or for other reasons. So the commission may be superceded for a particular purpose—as, in one instance, to enable the lunatic to make a will, though the case cited is of doubtful authority. If the lunatic be sufficiently recovered to make a will, he is sufficiently recovered to be free from the control of the committee altogether, in most instances. In case of the death or incapacity of the commissioners on the original inquisition, a new one may be directed to be issued.

III. THE DISPOSITION OF THE ESTATES OF LUNATICS, AND THE DUTY OF COMMITTEES.

1. *Duty and authority of the Committee, filing Inventory, &c.*—Every committee of the estate of any idiot, lunatic or person of unsound mind, shall, within six months after their appointment, file in the office of the clerk of the court which appointed such committee, a just and true inventory of the whole real and personal estate of such idiot, lunatic or person of unsound mind, stating the income and profits thereof, and the debts, credits and effects, so far as the same shall have come to the knowledge of such committee. And whenever any property belonging to such estate shall be discovered after the filing of any inventory, it shall be the duty of such committee to file as aforesaid a just and true account of the same from time to time, as the same shall be discovered. Such inventories shall be verified by the oath of the committee, to be taken before a judge of any court of record. The filing of such inventories may be compelled by the order and process usual in such cases, of the court which appointed the committee.

Receivers and committees of lunatics, appointed by any order or decree of the Supreme Court, may sue in their own names for any debt, claim or demand transferred to them or to the possession of which they are entitled as such receiver or committee; and when ordered or authorized to sell such demands the purchaser thereof may sue and recover therefor in his own name, but shall give such security for costs to the defendant as the court in which such suit is brought may direct. In an action prosecuted by a person expressly authorized by statute to sue in his own name, as in the case of the committee of a lunatic, the costs shall be chargeable only upon or collected of the estate, fund or party represented, unless the court shall direct the same to be paid by the plaintiff or defendant personally, for mismanagement or bad faith in such action. A person so expressly authorized by statute may sue without joining with him the person for whose benefit the action is prosecuted.

Under the direction of the court, and subject to the law imposing upon those having the care of lunatics the duty of sending them to the asylum, the entire control of the person of the lunatic rests with the committee, and they are bound to provide for his personal ease and comfort. As a general rule the committee cannot enter into any transaction or contract respecting the property of a lunatic without the authority of the court. If the lunatic's estate is large, and its interests require the employment of an agent or clerk, the court, upon the petition of the committee, will allow him to employ such agent or clerk, and pay him a reasonable compensation for his services out of the income of the estate; but the committee himself can not receive a compensation for services as such clerk beyond his allowance for commissions as the committee.

If waste is committed upon the lands of the lunatic, it is the duty of the committee to apply to the court for an order to restrain it.

Where the lunatic resides in another State and has property in the hands of his committee appointed at the place of his residence, that property is the primary fund for his support, and should be first applied for that purpose by the committee who has control of his person.

2. *Sale, Mortgage or Lease of Lunatic's Real Estate.*—(*a.*) *For payment of debts.*—Whenever the personal estate of any idiot, lunatic or person of unsound mind, for whom there is a committee appointed, shall not be

sufficient for the discharge of his debts, it shall be the duty of the committee of his estate to apply by petition to the court by which they were appointed, praying for authority to mortgage, lease or sell so much of the real estate of such idiot, lunatic, or person of unsound mind as shall be necessary for the payment of such debts. The said petition shall set forth the particulars and amounts of the estate, real and personal, of such idiot, lunatic or person of unsound mind, the application which may have been made of any personal estate, and an account of the debts and demands existing against such estate.

On the presenting of such petition, it shall be referred to a referee, or to the clerk of the court, to inquire into and report upon the matters therein contained, whose duty it shall be to examine into the truth of the representations made, to hear all parties interested in such real estate, and to report thereon with all convenient speed.

If, upon the coming in of the report and an examination of the matter, it shall appear to the court that the personal estate of the idiot, lunatic, or person of unsound mind is not sufficient for the payment of his debts, and that the same has been applied to that purpose, as far as the circumstances of the case rendered proper, an order shall be entered, directing the mortgage, leasing or sale of the whole or such part of the said real estate as shall be necessary to discharge the said debts.

The court may require any additional security to be given by any such committee, for the faithful application and accounting for the proceeds of such mortgage, lease or sale; and may require an account thereof to be rendered from time to time.

In the application of any moneys raised by any such mortgage, lease or sale, the committee shall pay all debts in an equal proportion, without giving any preference to such as are founded on sealed instruments.

(*b.*) *For Support.*—When the personal property and the rents, profits, and income of the real estate of any such idiot, lunatic, or person of unsound mind shall be insufficient for his maintenance, or that of his family, or for the education of his children, a similar application may be made by the committee to the Supreme Court, or to the court having jurisdiction, for authority to mortgage or sell the whole or so much of the real estate as shall be necessary for that purpose; upon which the same reference and proceedings shall be had, a like order shall be entered, as hereinbefore directed in the case of the application for a sale, mortgage, or lease in order to pay the debts of such insane person.

In the case last mentioned, the court shall direct the manner in which the proceeds of such sale shall be secured, and the income or produce thereof appropriated.

The court shall give such orders respecting the time and manner of any sale herein mentioned as shall be deemed proper; and no conveyance in pursuance of any such sale shall be executed until the sale shall have been reported on the oath of the committee, and confirmed by the court directing the same.

(*c.*) *Sale where the Interest of the Lunatic will be Promoted.*—By a late statute, a lunatic may by committee, or by the husband if the lunatic is a married woman, apply to the Supreme Court for the sale of any estate or interest in lands belonging to such lunatic. On such application the said committee, or the said husband, shall give bond to the lunatic (in addition to the bond given on the appointment of such committee,) to be filed with the clerk of the court, in such penalties and with such sureties as the court shall direct, for faithful performance of the trust imposed, accounting for all moneys received; and obeying all orders and directions of the court in relation to the trust, which bond if forfeited shall be prosecuted, by direction of the court, for the benefit of the party injured. Upon the filing of the bond the court may proceed in a summary manner, by reference, to inquire into the merits of the application, and whenever it shall appear satisfactory that the disposition of any part of the real estate or interest in lands of such lunatic, including the separate estate of any married woman who may be a lunatic, is necessary and proper either for the support and maintenance of such lunatic or for his education, or that the interest of such lunatic requires or will be substantially promoted by such disposition, on account of any part of such property being exposed to waste and dilapidation, or on account of its being wholly unproductive, or when the same has been contracted to be sold and a conveyance thereof cannot be made by reason of such lunacy, or for any other peculiar reasons or circumstances, the court may order the letting for a term of years, or the sale or other disposition of such real estate or interest, to be made by such committee in such manner and with such restrictions as shall be deemed expedient, or may order the fulfillment of said contract by conveyance by such committee according to the terms of the contract but no such real estate or interest shall be sold, leased, or disposed of in any manner against the provisions of any last will or of any conveyance by which such estate, or term, or interest was devised or granted to such lunatic.

The agreement to sell, etc., must be reported to the court as in other cases, and if the report be confirmed a conveyance will be executed under the directions of the court.

All sales, etc., made in good faith by such committee, in pursuance of such orders, shall be valid and effectual as if made by such lunatic when of sound mind.

The disposition of the proceeds of the property sold, etc., shall be made according to the order of the court, so as to secure the same for the benefit of such lunatic; and shall require accounts to be rendered periodically by any committee or other person who may be intrusted with the income of such proceeds. No sale, made in the manner provided, shall have the effect of giving the lunatic any other or greater interest or estate in the proceeds of the sale than he had in the estate sold, but the proceeds shall be deemed real estate of the same nature as the property sold. Acceptance of a gross sum may be granted in lieu of dower when a dower interest is the subject of sale, where the person entitled thereto shall consent in writing, or may direct the securing of a reasonable annuity in lieu of dower. But before any such sum shall be paid, or such annuity secured, the court shall be satisfied that an effectual release of such right of dower has been executed.

3. *Application for Conveyance where the Lunatic is Trustee, Specific Performance of his Agreements, Partition of his Estate, &c.*—Whenever any such idiot, lunatic, or person of unsound mind shall be seized or possessed of any real estate by way of mortgage, or as trustee for others in any manner, his committee may apply to the Supreme Court for authority to convey and assure such real estate to any other person or persons entitled to such conveyance or assurance, in such manner as the said court shall direct; upon which a reference and the like proceedings shall be had as in the case of an application to sell real estate, as before

mentioned; and the court, upon hearing all the parties interested, may order such conveyance or assurance to be made.

On the application of any person entitled to such conveyance or assurance, by bill or petition, the committee may be compelled by the Supreme Court, on a hearing of all parties interested, to execute such conveyance or assurance.

Every conveyance, mortgage, lease and assurance, made under the order of the Supreme Court, or of any court having jurisdiction, shall be as valid and effectual as if the same had been executed by such idiot, lunatic, or person of unsound mind when of sound memory and understanding.

The Supreme Court shall have authority to decree and compel the specific performance of any bargain, contract or agreement which may have been made by any lunatic, idiot, or person of unsound mind while such lunatic or other person was capable to contract; and to direct the committee of such person to do and execute all necessary conveyances and acts for that purpose.

The real estate of any idiot, lunatic or person of unsound mind shall not be leased for more than five years, or mortgaged or aliened or disposed of otherwise than as above directed.

In case any lunatic or other such person shall be restored to his right mind, his real and personal estate shall be restored to him.

In case of the death of any idiot, lunatic or person of unsound mind, the power of any trustees appointed as above shall cease, and his real estate shall descend to his heirs, and his personal estate be distributed among his next of kin, in the same manner as if he had been of sound mind and memory; but nothing in the foregoing provisions contained shall be held to affect the provisions of any last will and testament duly made, and which shall be duly admitted to probate.

4. *Effect of Issuing Commission, and of Inquisition.*—After a commission has been issued, persons purchasing property of, or otherwise dealing with the alleged lunatic, with a knowledge that the same has been issued, will do so at the risk of having their whole proceedings declared illegal and void.

The acts of a lunatic before he has been judicially declared to be of unsound mind are not void, but voidable. The courts of this State will not interfere to exonerate a lunatic from liability on his contract for property sold to him, if he has actually had the benefit of the property, and the contract was made in good faith, without knowledge of the incapacity, and where no advantage has been taken of the situation of the party. But, after his incapacity has been judicially ascertained, he can, as before stated, make no contract, nor delegate any power, nor waive any right, until his restoration to capacity is, in like manner, judicially declared.

With respect to acts done by a lunatic before the issuing of a commission, and which are over-reached by the finding of the jury on the commission, that is, where the jury by their return find that the lunatic was insane at the time of the acts in question, the inquisition is presumptive but not conclusive evidence of their invalidity.

IV. LEGAL PROCEEDINGS IN WHICH LUNATICS ARE PARTIES, AND THE SERVICE OF LEGAL PROCESS UPON THEM.

1. *Actions by or against an Insane Person for whom a Committee has been appointed.*—(*a.*) *By such person.*—Receivers and committees of lunatics, appointed by any order of the court, may sue in their own names for any debt to the possession or control of which they are entitled; and, when ordered or authorized to sell such de-

mands, the purchaser may sue and recover therefor in his own name, but shall give such security for costs as the court may direct.

Other actions affecting the person or property of the lunatic, except those above enumerated, must, by common law, be brought in the name of the lunatic, and not in the name of his committee. The New York Code has still further enlarged the power of the committee to sue. It is enacted that a trustee of an express trust, or a person expressly authorized by statute, may sue without joining with him the person for whose benefit the action is prosecuted, and that "a trustee of an express trust," shall be construed to mean a person with whom, or in whose name, a contract is made for the benefit of another. It has been held that the committee of an insane person is the trustee of an express trust, within the meaning of this section.

(*b.*) *Actions against such Persons.—Leave to sue.*—After a person is declared by inquisition to be insane, it is a contempt of court for a creditor, or other person, who is informed of the proceedings to sue the insane person, or levy an execution on his property, or otherwise interfere with it, without the leave of the court. And such creditor or other person, upon a proper application from the committee, will be restrained from such interference.

The proper course for the creditor, under such circumstances, when his claim is disputed or refused by the committee, is to apply to the court, by petition, for the payment of his debt out of the insane person's estate; or for leave to collect his claim by action, or to have a reference. If the court is satisfied that the debt is justly due, it will order the committee to pay it out of the estate; or, if doubtful, order a reference, or permit the party to establish his claim by action, in their discretion.

Mode of Conducting the Action. In general the action should be against the insane person alone.—In a case in which the committee has a personal interest in the controversy which may conflict with the insane person's, both should be made parties, and the court will appoint a guardian *ad litem* for the insane person.

Service of the Summons.—A civil action is commenced by the service of a summons. If the action be against a person judicially declared to be of unsound mind, and for whom a committee has been appointed, the summons may be served by delivering a copy thereof to such committee and to the defendant personally.

Provisional Remedies in an Action.—An insane person for whom a committee has been appointed, is not, of course, liable to arrest.

Effect of Judgment.—The judgment will bind the estate of the lunatic, and, as has already been seen, the committee may be compelled to perform his contract.

2. *Actions by or Against an Insane Person for whom no Committee has been appointed.* (*a.*) *Actions by such person.*—Until a person is judicially declared to be of unsound mind, there is nothing to prevent the commencement of an action in his own name. The proper course in such a case would be for the opposite party to apply to the court to have a committee appointed in the usual way.

(*b.*) *Actions against such Persons.*—A civil action may be carried on against an insane person, etc., in the same manner as against a sane person, the process being personally served. The insanity of the party defendant, however, would be good ground for opening a judgment rendered against him.

Provisional Remedies in such Action.—If any person imprisoned on attachment, or any civil process, becomes insane, the county judge of the county where he is confined shall institute a careful investigation, call two respectable physicians and other credible witnesses, and if necessary call a jury, notice of the proceedings having been first given by mail or otherwise to the plaintiff or his attorney, if in the State; and if it shall be proved to the satisfaction of said judge that the prisoner is insane, he may discharge him from imprisonment, and order him into safe custody, and to be sent to the asylum. Nevertheless, the creditor may renew his process, and arrest again his debtor when of sound mind.

3. *Other Legal Proceedings.*—In special proceedings, such for instance as summary proceedings before justices of the peace, for the ejectment of tenants, the insanity of the party proceeded against would not be a defence. The proceeding would be conducted as usual, the committee, if there was one, being made a party.

Legal papers and process affecting an insane person must be served upon the insane person personally, if no committee has been appointed. If a committee has been appointed it should be served upon both, in most instances. In some cases, service upon the committee alone would be sufficient.

Sometimes a petition or affidavit is sworn to by one who has been found by an inquisition to be of unsound mind. In such a case the officer before whom it is sworn should state in the jurat that he had examined the petitioner or deponent for the purpose of ascertaining the state of his mind, and whether he was capable of understanding the nature and object of the petition or affidavit, and that he was apparently of sound mind, and capable of understanding the same. And if the party is blind the officer should also certify that the petition or affidavit was carefully and correctly read over to him, in the presence of such officer, before it was sworn to.

V. LAWS REGARDING THE ADMISSION OF THE INSANE TO ASYLUMS, AND THEIR DISCHARGE THEREFROM.

1. *Persons Furiously Mad.*—(*a.*) *Who may commit such Persons to custody.*—When any person, by lunacy or otherwise, becomes furiously mad, or so far disordered in his senses as to endanger his own person or the person or property of others if permitted to go at large, and who is possessed of sufficient property to maintain himself, it shall be the duty of the committee of his person and estate to send him to the State Lunatic Asylum, or to such public or private asylum as may be approved by a standing order or resolution of the supervisors of the county.

If such person is not possessed of sufficient property to maintain himself, it shall be the duty of the father and mother and the children of such person, being of sufficient ability, to send him to the State Asylum or to a public or private asylum, as above mentioned.

In case of the refusal or neglect of any committee of such lunatic or mad person, or of his relatives, to send such person to the asylum, as aforesaid, or when there is no such committee or relative of sufficient ability, it shall be the duty of the overseers of the poor of the city or town where any lunatic or mad person shall be found, to apply to any two justices of the peace of the same city or town, who, upon being satisfied upon examination that it would be dangerous to permit such lunatic to go at large, shall issue their warrant, directed to the constables and overseers of the poor of such city or town, commanding them to cause such lunatic or mad person to be apprehended, and to be safely locked up and confined in such secure place as may be provided by the overseers of the poor to whom the same shall be directed, within the town or city of which such overseers may be officers, or within the county in which such city or town may be situated, or in the county poor-house in those counties where such houses are established, or in such private or public asylum as may be approved by any standing order or resolution of the supervisors of the county in which such city or town may be situated, or in the Lunatic Asylum of the city of New York; but such lunatic or mad person shall not be so confined for longer than the space of ten days, but within that time shall be sent to the said State public or private asylum, as before mentioned.

Any two justices of the peace of the city or town where any such lunatic or mad person may be found, may, without the application of any overseers of the poor, and upon their own view or upon the information or oath of others, whenever they deem it necessary, issue their warrant for the apprehension and confinement of such lunatic or mad person, for not longer than ten days, as aforesaid, and such lunatic or mad person shall in like manner be sent to the said State or private asylum.

In all the above cases it is provided that the lunatic shall be sent to the asylum within ten days. Temporary confinement in other places, not exceeding ten days, may be allowed. No such insane person, however, can be so temporarily confined in any prison, jail or house of correction, unless an agreement shall have been made for that purpose with the keepers thereof, nor shall such person be confined in the same room with any person charged with or convicted of any crime.

(*b.*) *How the duty of committing such Persons to custody may be enforced, and the mode of such commitment.*—The overseers of the poor shall have the same remedies to compel relatives of insane persons, being of sufficient ability, to fulfill the requirements of the provisions above recited, and to collect the costs and charges of non-fulfillment as are given by law in the case of poor and impotent persons becoming chargeable to any town, and it shall be the duty of the overseers of the poor to whom a justice's warrant shall be directed, as above provided, to procure a suitable place for the temporary confinement of such lunatic, as therein directed.

An overseer of the poor, constable, keeper of a jail, or other person, who shall confine any lunatic or mad person in any other manner or in any other place than such as are by law prescribed, shall be deemed guilty of a misdemeanor, and on conviction shall be liable to a fine not exceeding two hundred and fifty dollars, or to imprisonment not exceeding one year, or to both, in the discretion of the court before which the conviction shall be had.

The county superintendents of the poor shall have all the powers and authority above given to overseers of the poor of any town, and both superintendents and overseers are severally enjoined to see that the provisions of law regarding the transfer of the insane to the asylum be carried into effect in the most humane and speedy manner, as well in case the lunatic or his relatives are of sufficient ability to defray the expenses as in case of a pauper.

In every case of confinement of a lunatic or mad person, as herein above mentioned, (in the asylum or elsewhere,) whether of a pauper or not, neither justices, superintendents or overseers of the poor shall order or approve of such confinement without having the evidence of two reputable physicians under oath as to the alleged fact of insanity, and such testimony shall be reduced to writing, and filed, with a brief report of all the other proofs, facts and proceedings in the case, in the office of the county clerk; and said clerk shall file said papers and register, with dates, the names and residence of the lunatic and officers, severally, in tabular form, in the book of miscellaneous records kept in said office, and the certificate of said clerk, and seal of the court, verifying such facts, shall warrant such lunatic's admission into the asylum.

If any lunatic confined under the laws herein before mentioned, or any friend in his behalf, be dissatisfied with any final decision or order of the justices, or of any overseer or superintendent of the poor under such laws, he may, within three days after such order or decision, appeal to one of the judges of the county, making complaint on oath, and such judge shall thereupon stay his being sent out of the county, and forthwith call a jury to decide upon the fact of lunacy; after a full and fair investigation, aided by the testimony of two respectable physicians, if such jury shall find him sane the judge shall forthwith discharge him, otherwise he shall confirm the order for his being immediately sent to an asylum. In case the justices refuse to make an order for confinement, they shall state their reasons for such refusal in writing, so that any person aggrieved thereby may appeal as above to a county judge, who shall hear and determine the matter in a summary way or call a jury, as he may think most fit and proper. In every case of appeal the judge shall have the same power to take testimony and compel the attendance of witnesses and jurors as a justice has in civil cases.

2. *Indigent Persons, not Paupers.*—When a person in indigent circumstances, not a pauper, becomes insane, application for a certificate of admission to the asylum may be made in his behalf to the county judge of the

county where he resides; but no such certificate can be granted unless the person has become insane within one year next prior to the granting of the certificate by the judge. It is the duty of the judge, when such an application is made to him, to cause such notice thereof, and of the time and place of hearing the same, to be given to one of the superintendents of the poor of the county chargeable with the expense of supporting such person in the asylum, if admitted, or, if such expense is chargeable to a town or city, then to an overseer of the poor of such town or city, as he may deem reasonable. The judge, at the time and place of hearing, must call two respectable physicians and other credible witnesses, and fully investigate the facts of the case, and (either with or without the verdict of a jury, at his discretion, as to the question of insanity,) must decide the case as to his indigence. He must also enquire as to the time when the person became insane. He has power to compel the attendance of witnesses and jurors. Upon all the facts being proven, according to law, it is the duty of the judge to make and execute a certificate that satisfactory proof has been adduced showing the person to be insane, and that he became insane within one year next prior to the date of the certificate, and that his estate is insufficient to support him and his family, (or, if he has no family, himself,) under the visitation of insanity.

The certificate must be authenticated by the county clerk, under his hand and the seal of the county court, and when authenticated is authority for carrying such insane person to the asylum, and must be taken by the friend having such person in charge, and delivered to the superintendent of the asylum. Such person is then to be admitted, and supported at the expense of the county until restored to soundness of mind, if effected in two years.

It is the duty of the judge to file the certificate of the physician called before him, taken under oath, and other papers, with a report of his proceedings and decisions, with the clerk of the county, and also to report the facts of the case to the supervisors, whose duty it is, at their next annual meeting, to raise the money requisite to meet the expenses of support accordingly.

When an indigent patient, under a judge's certificate, has remained in the asylum two years and has not recovered, it is the duty of the superintendent to send notice thereof, by mail, to the overseer of the poor of the town from which the patient was sent, or to the county judge, stating that he should be removed from the asylum, and that if he is not removed his expenses will be chargeable to the county until the removal is made; but in every case of an indigent patient who has remained in the asylum two years and not recovered, the managers may, in their discretion, return him to the county from which he came, and charge the expense of the removal to the county.

When an insane person, in indigent circumstances, shall have been sent to the asylum by his friends, who have paid his bills therein for six months, if the superintendent shall certify that he is a fit patient, and likely to be benefited by remaining in the institution, the supervisors of the county of his residence are authorized and required, upon an application under oath in his behalf, to raise a sum of money sufficient to defray the expenses of his remaining there another year, and pay the same to the treasurer of the asylum; and they shall repeat the same for two succeeding years, upon like application, and the production of a new certificate each year of like import from the superintendent.

The county judge of each of the counties of this State is hereby authorized to send all such indigent lunatics belonging to each county as may be brought before him, either to the county poor-house or to the State Lunatic Asylum, as in his judgment may be for the best interests of all concerned.

Whenever a county judge shall be precluded from acting in the proceedings above mentioned by reason of relationship by consanguinity or affinity to any lunatic in indigent circumstances, application may be made in behalf of such lunatic to one of the justices of the sessions resident of the county in which such lunatic resides, and the same proceedings had before such justices as might be had before the county judge, but for the latter's disability.

3. *Criminals, and Persons under Criminal Charge, and Persons in Prison, &c.*—When a person shall have escaped indictments, or shall have been acquitted of a criminal charge upon trial, on the ground of insanity, the court, being certified by the jury, or otherwise, of the fact, shall carefully inquire and ascertain whether his insanity, in any degree, continues; and if it does shall order him in safe custody, and to be sent to the asylum.

If any person in confinement under indictment, or under sentence of imprisonment, or under a criminal charge, or for want of bail for good behavior, or for keeping the peace, or for appearing as a witness, or in consequence of any summary conviction, or by order of any justice, or under any other than civil process, shall appear to be insane, the county judge of the county where he is confined shall institute a careful investigation, call two respectable physicians and other credible witnesses, invite the district attorney to aid in the investigation, and, if he deem it necessary, call a jury, (and for that purpose is fully empowered to compel the attendance of witnesses and jurors,) and if it be satisfactorily proved that he is insane may discharge him from imprisonment and order his safe custody and removal to the asylum, where he shall remain until restored to his right mind; and then, if the said judge shall have so directed, the superintendent shall inform the said judge and the county clerk and the district attorney thereof, so that the person so confined may, within sixty days thereafter, be remanded to prison and criminal proceedings be resumed, or otherwise discharged; or if the period of his imprisonment shall have expired, he shall be discharged.

If, as already stated, a person imprisoned on attachment or any civil process, or for non-payment of a militia fine, becomes insane, the county judge shall institute like proceedings as are provided for in the last-mentioned case; but notice shall, in such case, be given by mail or otherwise to the plaintiff or his attorney, if in the State; and if it shall be proven to the satisfaction of said judge that the prisoner is insane, he may discharge him from imprisonment, and order him into safe custody, and to be sent to the asylum. Nevertheless the creditor may renew his process, and arrest again his debtor when of sound mind.

Persons charged with misdemeanors and acquitted on the ground of insanity, may be kept in custody and sent to the asylum in the same way as persons charged with crime.

4. *Idiots, Paupers, and other Insane Persons not included in the previous classes.*—The county superintendents of any county, and the overseers of the poor of any town, to which any person shall be chargeable who shall be or who shall become a lunatic, *are required* to send such lunatic within ten days to the State Lunatic Asylum, or to such public or private asylum as shall be approved by a standing order or resolution of the superintendents of the county.

It is made the duty of superintendents and overseers (as before mentioned,) to see that the provisions of law in reference to sending the insane to the asylum, be carried into effect in the most humane and speedy manner.

Idiots.—There shall be received and supported gratuitously in the State Asylum for Idiots one hundred and twenty pupils, to be selected in equal numbers, as near as may be, from each judicial district, from those whose parents or guardians are unable to provide for their support, therein to be designated as State pupils; and such additional number of idiots as can be conveniently accommodated may be received into the asylum by the trustees, on such terms as may be just. But no idiot shall be received into the asylum without there shall have been first lodged with the superintendent thereof a request to that effect, under the hand of the person by whose direction he is sent, stating the age and place of nativity, if known, of the idiot, his christian and surname, the town or city and county in which they severally reside, the ability or otherwise of the idiot, his parents or guardians to provide for his support in whole or in part, and if in part only then what part, and the degree of relationship or other circumstance of connection between him and the person requesting his admission; which statement shall be verified in writing by the oath of two disinterested persons, residents of the same county with the idiot, acquainted with the facts and circumstances so stated, and certified to be credible by the county judge of the same county; and no idiot shall be received into said asylum unless the county judge of the county liable for his support shall certify that such idiot is an eligible and proper candidate for admission to said asylum, as aforesaid.

Discharge of Patients from the State Asylum.—The managers, upon the superintendent's certificate of complete recovery, may discharge *any patient*, except one under a criminal charge, or liable to be remanded to prison. And they may discharge any patient admitted as dangerous, or any patient sent to the asylum by the superintendents or overseers of the poor, or by a county judge, upon the superintendent's certificate that he or she is harmless, and will probably continue so, and is not likely to be improved by further treatment in the asylum,—or, when the asylum is full, upon a like certificate that he or she is manifestly incurable, and probably can be rendered comfortable at the poor-house; so that preference may be given, in the admission of patients, to recent cases of insanity of not over one year's duration.

The managers may discharge and deliver any patient, except one under criminal charge, as aforesaid, to his relatives or friends who will undertake with good and approved sureties for his peaceable behavior, safe custody and comfortable maintenance, without further public charge. *A patient of the criminal class* may be discharged by order of one of the justices of the Supreme Court, if upon due investigation it shall appear safe, legal and right to make such order.

The whole duty of the discharge and removal of patients (except in criminal cases,) is devolved upon the managers and the superintendent of the asylum. The county judges, justices, superintendents and overseers of the poor have no authority to discharge or remove them. When a discharge is desired, application must be made to the superintendent, so that it may be considered.

The managers are, by a late law, authorized to appoint two or more of the attendants and employees of the asylum as policemen, whose duty it shall be, under the orders of the superintendent, to arrest and return to the asylum insane persons who may escape therefrom.

Discharge of patients from County poor-houses, etc.—No insane person confined in any county poor-house or county asylum shall be discharged therefrom by any keeper of such establisment, by any superintendent of the poor, or by any other county authority, without an order from a county judge or judge of the Supreme Court, founded upon satisfactory evidence that it is "safe, legal and right" to make such discharge, as regards the individual and the public. The violation of this provision shall be deemed a misdemeanor, and be punishable by a fine not exceeding five hundred dollars nor less than one hundred dollars, in the discretion of the court.

VI. LAWS REGARDING INSANE CONVICTS.

1. *Admission into State Asylum for Insane Convicts.*—Whenever the physician of either of the state prisons of this State shall certify to the board of inspectors or to the inspector in charge that any convict confined therein is insane, it shall be the duty of such board or of such inspector in charge to make immediately a full examination into the condition of such convict, and if satisfied that he is insane the said board of inspectors or the inspector in charge may order the agent or warden of the prison where such convict is confined forthwith to convey said convict to the State Asylum for Insane Convicts, at Auburn, and to deliver him to the superintendent thereof, who is hereby required to receive him into the said asylum and retain him there until legally discharged.

Whenever any convict in the State Asylum for Insane Convicts shall continue to be insane at the expiration of the term for which he was sentenced, the board of inspectors, upon the superintendent's certificate that he is harmless and will probably continue so, and that he is not likely to be improved by farther treatment in the asylum, or upon a like certificate that he is manifestly incurable and can probably be rendered comfortable at the county alms-house, may cause such insane convict to be removed, at the expense of the State, from said asylum to the county wherein he was convicted, or to the county of his former residence, and delivered to and placed under the care of the superintendent of the poor of such county, and the said superintendent is hereby required to receive such insane convict under his charge; they may also discharge and deliver any convict whose sentence has expired, and who is still insane, to his relatives or friends who will undertake, with good sureties, to be approved by said superintendent of the State Asylum for Insane Convicts, for his peaceable behavior, safe custody and comfortable maintenance without further public charge; and no convict shall be retained in the said State Asylum for Insane Convicts after the expiration of his sentence to the state prison, unless by the order of the county judge of the county in which said asylum is situated; and the said county judge, upon the application of the said superintendent, shall proceed to investigate the question of the insanity of such convict, and shall cause two respectable physicians to be designated by him to examine said convict, and upon their evidence under oath, and upon such other testimony as he shall require, shall decide the case as to his insanity, and if he is satisfied that such convict is insane shall make an order that the said convict shall be retained in the said asylum until he is recovered of his insanity, or is otherwise discharged according to law.

2. *Discharge of Insane Convicts from the Asylum.*—Whenever any convict who shall have been confined in

the said asylum as a lunatic shall have become restored to reason, and the medical superintendent of said asylum shall so certify in writing, he shall be forthwith transferred to the Auburn State Prison, and the agent and warden of said prison shall receive said convict into the said prison, and shall in all respects treat such convict as if he had been originally sentenced to imprisonment in said prison, though said convict may have been conveyed to the said asylum from either of the other prisons of this State.

RECAPITULATION OF THE FOREGOING LAWS.

1. *Disabilities of the Insane.*—The incapacity of the insane to perform any legal act is a familiar part of the law of all the United States, as well as of all civilized countries.

The only questions of difficulty arise in the application of this principle to actual cases, when it becomes necessary to define the degree of insanity which amounts to legal incapacity, particularly in regard to criminal responsibility, or the power to make a will. The rules established in New York upon these points are only to be gathered from the reports, and constitute no part of our statutory law.

2. *Custody of the Person and Estate of the Insane.*—The general care of the insane is committed to the Supreme Court. To that tribunal application must be had to obtain the appointment of a committee, and the question of the insanity of the alleged lunatic is decided by a jury. Upon the recovery of the insane person for whom a committee has been appointed he is himself at liberty to apply to the court, and the question whether the commission should be superseded will be judiciously investigated.

The policy of the statute, which substantially follows the common law and exhibits the same jealous regard for personal liberty, is to throw the protection of a jury trial and open judicial investigation around every case of alleged insanity, and to prevent, as far as possible, the deprivation of liberty or the control of property without ample proof of the necessity of such deprivation, and to supply ready means to obtain both liberty and property when the necessity for restraint no longer exists.

Those who are intrusted with the property of the insane stand on the same footing with other guardians, and by heavy bonds and severe penalties are held to the faithful performance of their trust; abuses undoubtedly occur from the occasional dishonesty of committees, just as others acting in a fiduciary capacity sometimes take advantage of their position, and are not detected, but the fault lies not in the law itself but in the neglect, ignorance or corruption of those who administer it.

3. *Legal Proceedings Affecting the Insane.*—There is no difficulty in conducting legal proceedings for or against the insane when a committee has been appointed, and in case such proceedings become necessary, the proper course is to immediately apply for the appointment of a committee. Otherwise, although the course of proceeding will be the same as in case of a person of sound mind and memory, a judgment obtained or other judicial determination made will be liable to be set aside at the instance of the insane person, upon his recovery. It will be seen, however, that there is no adequate protection afforded to an insane person in the possession of property, for whom no committee has been appointed, against designing relatives or others who might enforce fraudulent claims against the property of such an one, and inflict an injury which could never be remedied. It would be well if there was a

statute requiring all legal process sought to be served upon a patient at an asylum to be submitted to the superintending physician, and to make it the duty of the latter to report the fact to the court where the proceedings have been instituted. It will be seen that in some instances personal service upon the insane person is proper, as part of a formal proceeding, but the mode suggested would give immediate information to the court of any attempt to make an improper use of the forms of law.

The only protection against the imprisonment of the insane on civil process is the power given to the county judge to discharge one so imprisoned, and send him to the asylum.

4. *Admission to and Discharge from Asylums.*—When a person becomes violently insane, so as to endanger the security of himself or of others, the duty of sending him to the asylum is compulsory, and may be enforced by legal proceedings. This duty, it will be seen, devolves upon various parties in succession, first upon the relatives, and then upon the public officers of the town or county where such insane person resides. So criminals, or persons under criminal charge, or persons in prison, if insane and their insanity satisfactorily established by the mode directed in the statute, not only may but must be sent to the asylum; and the omission to do so is a breach of duty upon the part of the county judge within whose jurisdiction the case arises. The proper county or town officers, also, are required to send to the asylum those insane persons who would otherwise become a public burden.

In the case of all other insane persons, it is left to their own option, or the option of those having them in charge, whether or not they will send them to the asylum. Certain provisions are made for indigent persons not paupers, and idiots are provided for at the State Asylum for Idiots, at Syracuse.

As has already been said, the whole duty of discharging patients, other than criminals, depends upon the managers and superintendent of the asylum. In case of a wrongful detention by these officers, the remedy would be an action of false imprisonment.

5. *Insane Convicts.*—The duty of sending insane convicts to the asylum for such persons devolves primarily upon the physician of the prison, whose duty it is to certify to the insanity of the convict. There is an old statute which allows the warden or inspector to institute an investigation into the sanity of any convict; and in event the physician should neglect to perform his duty, it is possible the statute referred to would enable the warden to remedy the neglect. The point, however, has never been decided.

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